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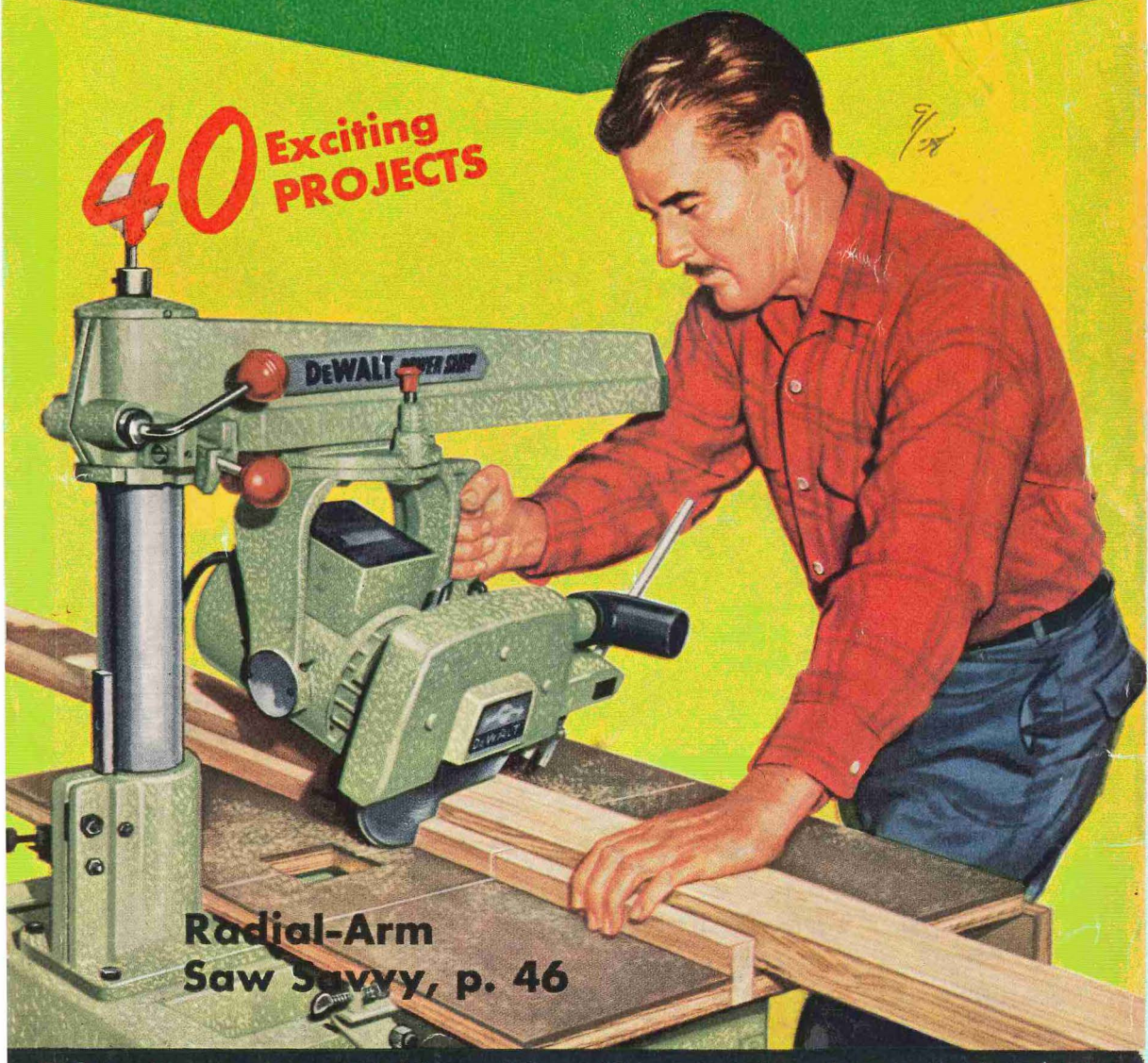

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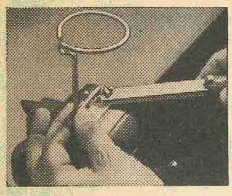

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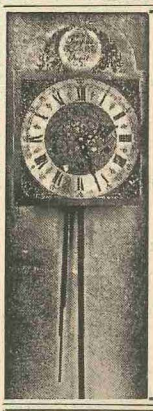

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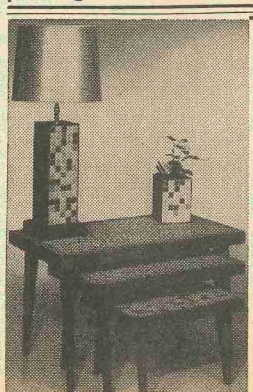

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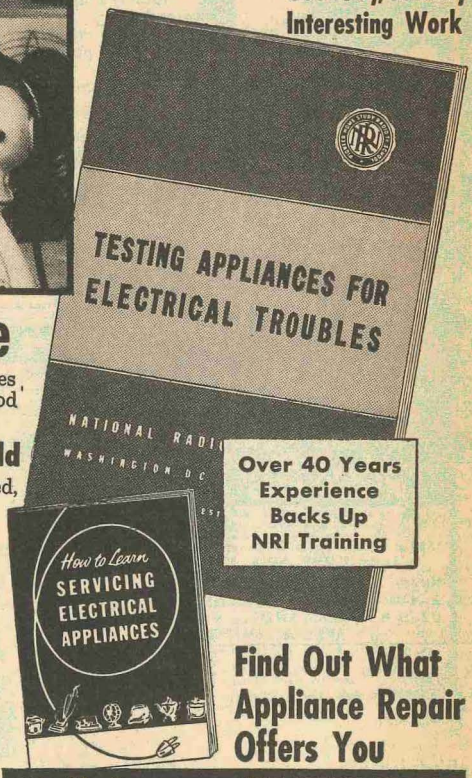

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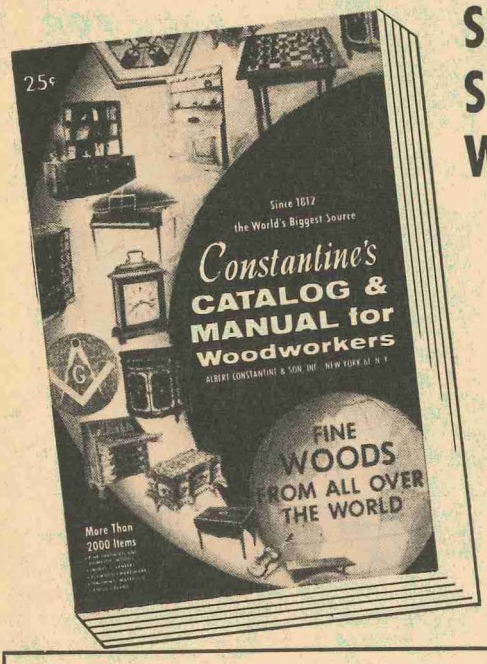

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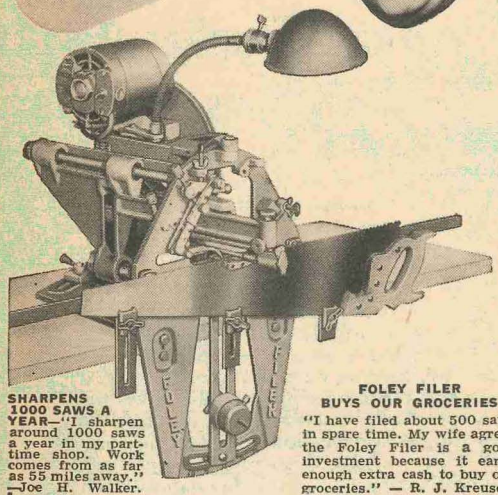

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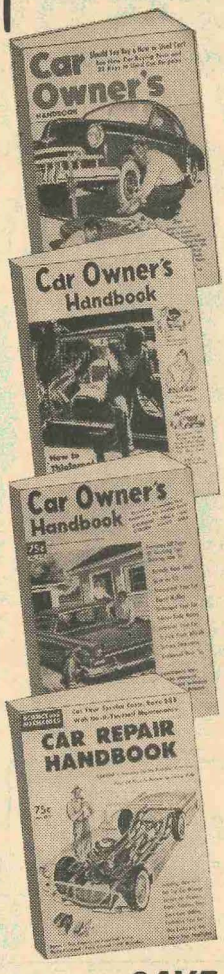

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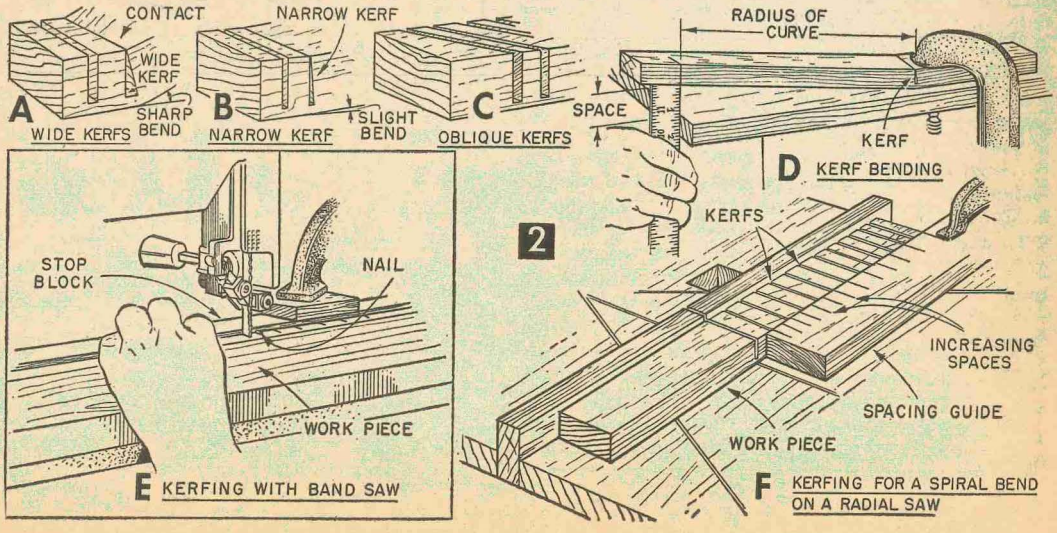
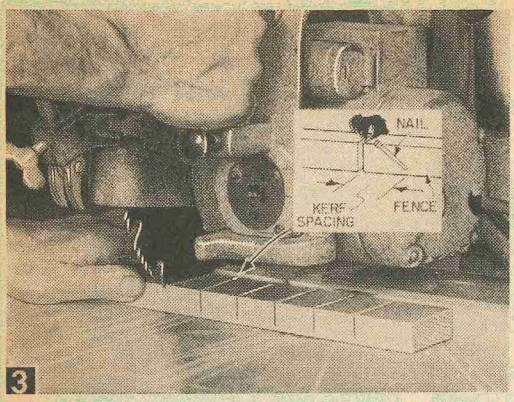
Examples of different types and methods of bending wood: (A) strips wood laminated and bent in a form, (B) solid wood steamed and bent, (C) veneered stock kerfed and bent to form a helix, (D) solid stock bent to an arc of a circle by uniformly spaced kerfs, (E) veneered stock bent to shape of a spiral by increasing space between kerfs 1/32 in. from small end of curve.

By MILT EVANS

YOU'LL have to know the tricks of bending wood if you are going to build a toboggan, skis, or furniture and cabinets requiring curved boards, veneer or plywood. Gentle sweeps can be negotiated by springing the wood, but special treatment is needed for sharp curves or spiral and helix bends as in Fig. 1.

The old methods used by carpenters for bending wood are still good for many jobs. In this process the board to be bent is saw cut with a series of incomplete cuts or kerfs on the inner face across the width, thus reducing the effective thickness of the wood to about one-sixth. As the piece is bent, the tops of the kerfs close, making





Cutting kerfs with a radial saw. A nail driven into saw-table fence spaces cuts for uniform spacing.

contact and limiting the bend at any one kerf as in Figs. 2A and B. Also, the wider the kerf is cut, the sharper the bend per kerf. If the kerfs are evenly spaced and close together, the curve will be uniform, producing an arc of a circle (Fig. 1). The wider the spacing between cuts the greater the strain on the wood, and noticeable flats will be apparent on the outside curved surface which must be sanded out to give a smooth continuous curve.

To reduce flats by spacing the kerfs closely, use a saw blade that will produce the narrowest cut or kerf. Spacing of kerfs is determined by making a sample cut in a scrap of wood of the type to be bent, and then laying off the radius of the curve to be bent from the saw kerf. Clamp the kerfed end to a bench as in Fig. 2D, and lift the end of the piece until the kerf closes. Then measure the distance from the bench top to wood at the radius mark. This distance is the spacing unit to use between saw cuts to obtain a curve having a radius of that particular length.

To cut uniformly spaced kerfs, drive a nail into the miter gage extension of a table saw or the fence of a radial saw (Fig. 3) at a distance from the center of the blade thickness equal to the required kerf spacing. When sawing the kerfs, move the board over so that the nail is between the edges of the last cut kerf. After the length of the board to be bent is kerfed, bend it around the shelf or other supporting member it is to be fastened to, and glue, nail or otherwise fasten it. Sand out any flats resulting from bending.

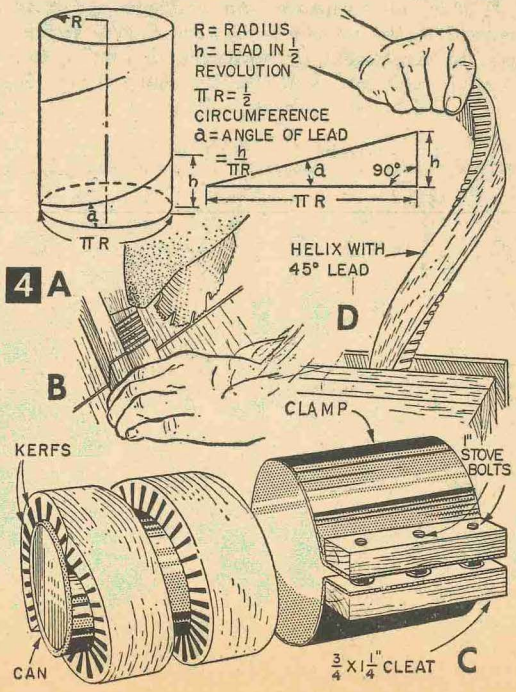
To make the bent piece self-supporting, brush glue over the kerfed side and work the glue into the kerfs with a knife blade. Then bend the piece to the desired curve, spanning the ends with a clamp, a strip of wood with limiting blocks nailed to it, or a loop of rope twisted to shorten it. Wipe off squeezed out glue with a damp cloth. The kerfed face and edges can be filled with wood putty and sanded smooth, or veneering will hide the kerf joints.

The narrow kerf made by a band-saw blade makes it an excellent tool for kerfing. Clamp a stop block of 2-in. stock a little wider than the width of the stock to be kerfed to the band-saw table, placing it behind the blade where it will limit the depth of cut to the required amount in the piece to be bent. Make a starting kerf in this piece and drive a nail in the stop block to locate the position of the second kerf. Enter this pin successively in the kerfs just cut to maintain uniform spacing as in Fig. 2E.

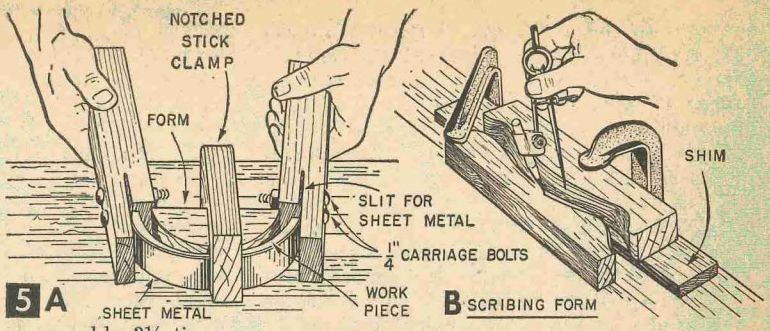
Elliptical and other variable curves are made by varying the spacing between the kerfs. While such spacing can be determined by involved mathematical computations, the most practical method is trial and error. By simply adding a little to each successive space, such as $\frac{1}{32}$ in., a spiral form as in Fig. 1 can be made. To make a spacing guide, lay out increasing spaces on a strip of wood and clamp it to the saw table as in Fig. 2F. For example, increase each space by $\frac{1}{32}$ in. over the preceding one. Place the end of the work piece at the first mark, saw a kerf, and move to the next mark for the second cut and so on.

To duplicate a spiral curve, estimate the radii at various points and test the spacing with cuts in scrap wood. Then mark the spacing of this cut on the piece to be kerfed and locate the spacing for the other kerfs, increasing them as the curve flattens or becomes larger and reducing the spacing as the curve grows sharper. It is better to have too many kerfs than not enough, as the piece can be painted with glue, bent around a form, and left until dry. Veneering the kerfed side adds considerable strength to the piece, particularly when the kerfs don't close tightly.

If a strip of wood is wound spirally around a cylinder, a helix (Fig. 1) is formed. For such a bend, the kerfs must be made at an angle rather



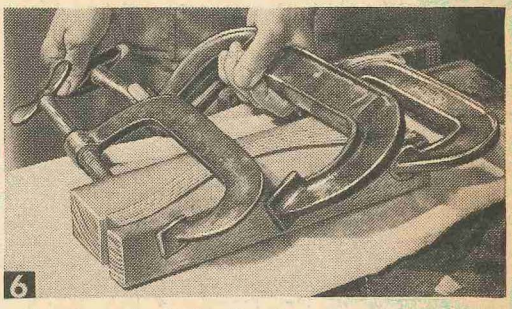
than at 90° with the edge of the strip. The rate of climb, or lead of the helix (Fig. 4D) determines the kerf spacing of a piece of given width. The angle of lead is found by dividing the distance of rise in one revolution by the circumference of the cylinder, or simply by dividing the rise "h" of half a revolution by Pi R, or roughly 3⅐ times the radius (Fig. 4A). If the cylinder form is at hand, the circumference can be obtained by wrapping a strip of paper around the form. The angle of cut with the square line is the same as "a," the angle of lead.



To kerf with a table saw, set the miter gage at the angle of lead. On a radial saw, as in Fig. 4B, swing the track arm to the angle, using a nail for a spacing pin as for square kerfing. After sawing the kerfs, bend the spiral around a form. In many cases a tin can will serve as in Fig. 4C. Remember that the spacing of kerfs must be according to the inside diameter of the helix, or the radius of the form cylinder. A convenient clamp can be made from sheet metal cut to fit around the helix, with edges bent out and bolted to strips of wood, which act as clamping ledges. Apply glue to the kerfs, bend around the form, and secure with the clamp. For a substitute clamp, wind a small rope around the work as it is bent.

Commercially, solid wood is steamed to soften or plasticize it for bending, and is then bent to shape in a power press. The small shop can steam small strips of wood by inserting them in a length of transite pipe, gutter downspout, or similar container. Just cap one end of the container and seal a teakettle spout into the other end by wadding steel wool around it. A hotplate or torch will heat the water. More success can be expected if the piece is boiled. Small pieces can be boiled in a baking pan. A minimum of 1 hour of boiling per 1 in. of thickness is required.

Select wood carefully for bending. Use only clear, straight-grained material free from checks or other defects, and coat the ends with aluminum paint to prevent too much soaking and softening there. On sharp bends there may be breakage, in spite of careful preparation, so have a spare piece on hand. While the wood is steaming or boiling, prepare the bending forms. Easy bends, such as hoops, can be made with stakes driven into the ground. But a small tight bend requires support and force from all directions as in Fig. 5A. The elements of this press are two handles cut from 2 by 2-in. lumber, with notches to provide pressure lugs for the ends of the piece being bent, slits to take the ends of a strip of sheet metal, and extensions beyond the lugs to reinforce the bent ends. An inside form cut from wood to the curve of the inner face of the strip is held in place by a notched-stick clamp which clasps over the sheet-metal band.



Clamping strips in bending form to make the laminated bent piece shown in Fig. 1.

Cut the metal band to such a length that when inserted in the handle slits and bolted, the lugs will be a very little closer together than the length of the piece being bent. Remove the piece from the water, place it in the press quickly, bending the handles back enough to seat its ends, and put the inner form in place with the notched stick. Bend the wood by swinging the handles together until a little past parallel, and hold with a cord loop. If there are any places where the wood springs away from the inner form, add a clamp to force it into position. Let dry in the clamp for 24 hours or more. As there will be some spring-back, cut the form so that you can over-bend the piece.

Nearly-dry bends can be made by lamination, in which strips of wood are glued together in a curved form (Fig. 6), and held in the form until well dried. To make the form, lay out on a piece of lumber of necessary thickness the curve of the piece desired, and bandsaw to shape. File or sand smooth any irregularities of cutting. Shim this piece up from the bench top with a strip of wood (Fig. 5B), and clamp it in position. Clamp the other form piece beside the first, separated ⅛ in. less than the thickness of the finished work, and with scribers or compass set to the thickness of the work piece to be clamped, scribe a line on the second piece. Then bandsaw and smooth this form piece.

When bending a laminated piece, first coat the joining surfaces of the strips with glue, even up the edges as they are laid together, and clamp between the two forms. Allow the assembly to dry thoroughly, remove from the forms, and then cut

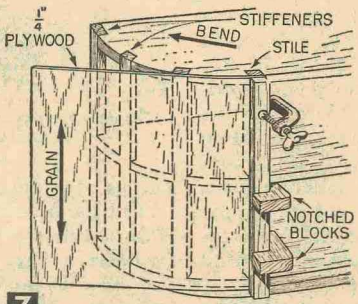
the edges to the size required for the project.

Fir 3-ply, ¼ in. thick plywood can be bent around a curved corner with a radius as small as 10 in. if applied with the grain of the outside plies running at right angles to the bend as in Fig. 7, and the outer ply well dampened with water to expand it. In addition to the shelves, use 1 by 2-in. stiffeners with faces rounded to match the curve and notched into the shelves. Begin by gluing and nailing one edge to the center of a stile placed at the beginning of the bend, reinforcing it with a strip clamped outside with C-clamps or pieces of 2 by 4-in. stock notched to fit tightly over the assembly. Gently spring the plywood around the curve, nailing as you go, and finish by gluing and nailing the back edge, finally trimming the plywood flush with the back.

If nails would be objectionable, contact cement will do the job. Mark the shelf and stiffener positions on the back of the plywood and paint on the cement. Also coat stiffeners and shelf edges. If wood absorbs cement, apply a second coat on all joining surfaces. Wait until cement dries before applying plywood. The cement should appear as a continuous glossy film when dry. After a wait of 30 minutes or more, or when a piece of paper pressed against the cement does not stick, apply the plywood.

Since touching of the two cemented surfaces together gives instant bond, care in placing plywood is important. Clamp a guide strip to the starting stile, place the starting edge of the plywood against it, and swing the sheet against the cabinet, again working from the starting edge forward. Rub and tap into place, and tap all cemented areas with a hammer and block to make sure of good contact.

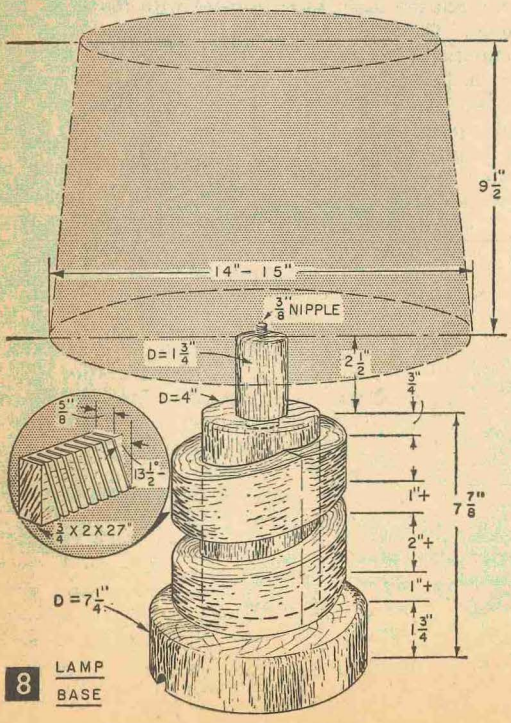
When the curve is too sharp for ¼-in. or thicker plywood, the back of the sheet can be kerfed to help bend it. Hardwood plywood, having a thick core, is likely to be stiffer than fir plywood, requiring a larger radius for bending. When a surface of figured hardwood is desired, it is better to use two or more thicknesses of ⅛-in., 3-ply plywood. Nail, or brad and glue into place a sheet of inferior plywood as a foundation. Work out flats or unwanted sharp bends and coat it with contact cement. Coat the back of the figured plywood sheet and apply as described before. With thicker facings, apply ¼-in. fir plywood as a base, kerfing it if necessary, and truing the face.



7 SHEATHING CABINET CURVE

Bent wood can be used in many interesting designs, as in the lamp base, Fig. 8. The core of this assembly is a 4-in. cylinder of dark wood, such as mahogany, joined with a tenon to a mahogany base, with a helix of blond wood, such as ash plywood, winding around the mahogany base. Kerf the back of the ash strip ⅝ in. deep, inclining the cuts with the vertical a scant 13½°. Apply glue to kerfed side and form it over the core which must first be covered with two thicknesses of paper taped in place. When the glue on the helix is dry, trim off the ends flush with top and bottom of core leaving 1½ turns of the strip. Fill the edges of the kerfs with wood putty, let dry, smooth, and glue the helix in place, around the core. Paint the edges to match the light wood. Bore the base with a ⅜-in. bit to pass the electric cord, and gouge a groove in the base to bring the cord outside. Screw a ⅜-in. brass nipple into the top, surmounting it with the socket and shade harp. A shade of the size shown in Fig. 8 is about the right size for this lamp base.

Finish with or without wood filler, as desired. Apply three or four coats of Deft and rub down with #000 steel wool. Brisk rubbing with a soft cloth increases the gloss.

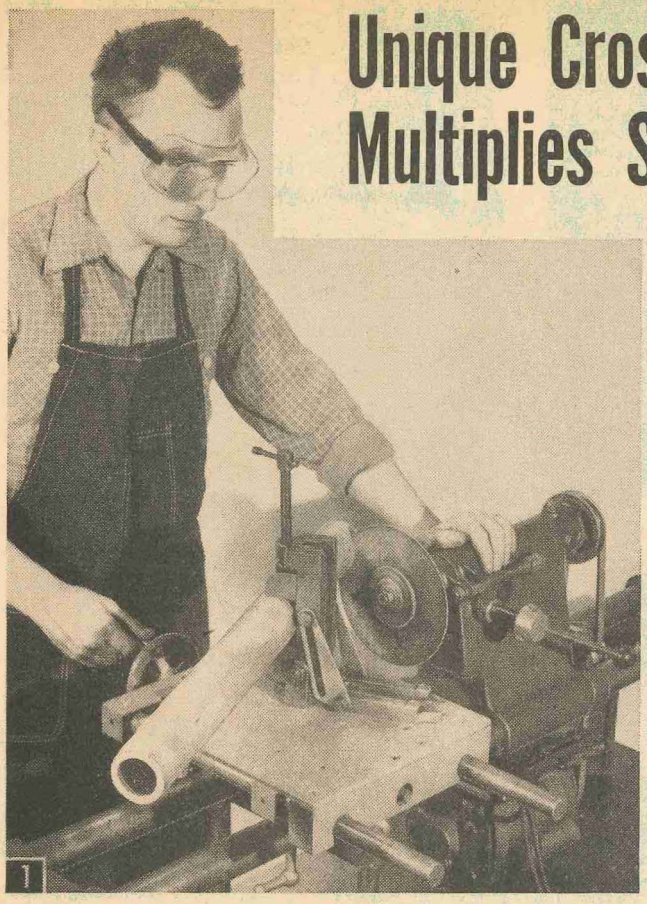


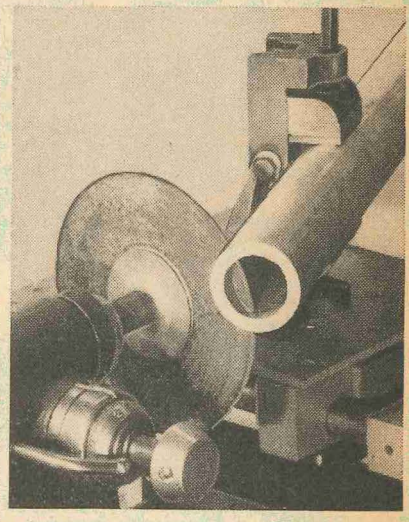
8 LAMP BASE

Peg Board Cord Storage

• You can store your power cords right on your peg-board toolboard and handy to the tools you use them with, with the help of an empty adhesive tape spool. Just whittle a plug to fit the spool hub, drill to take a long bolt and bolt assembly to pegboard at desired spot. For plywood or other tool boards, use regular wood screw.—FRANK A. JAVOR.

Unique Cross-Feed Table Multiplies Shopsmith Uses





Cutting this big steel tube accurately would have been a tough job by hand. The cross-feed and vise produce a precise angle cut, with the high-speed flexible abrasive wheel. Feed slowly, standing away from the cutting line, and ALWAYS wear safety glasses.

You can cut, grind slots, or mill metal with slip-proof precision, using this versatile accessory

By BILL McHUGH

BORROWING a design principle from big machine tools, this cross-feed table takes advantage of the double-column strength of the Shopsmith, to give you a means of feeding work to the tool, with controlled precision.

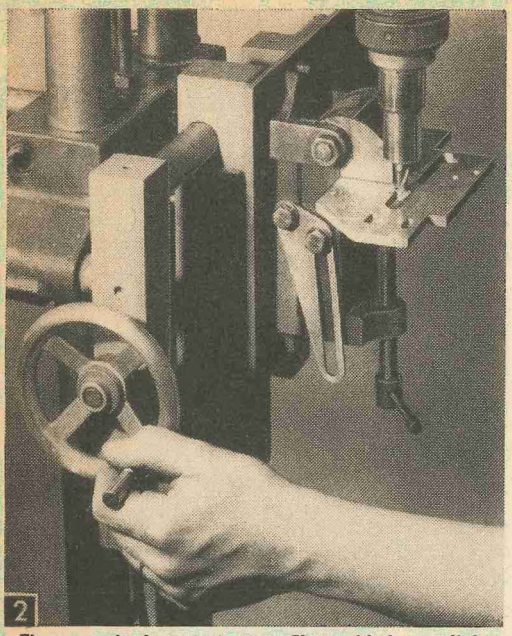
The cross feed has three main advantages: as in Fig. 1, you can use it with an adjustable vise to cut, drill, sand, and saw at practically any angle. Or, (Fig. 2) you can use it to slowly feed the work to a cutting tool to do a job that usually would require a milling machine. Figure 3 shows it doing a precise metal sawing job.

While the cross-feed attachment is shown on the Shopsmith model 10-ER, it will work equally well on the later Mark II, and Mark V models, and also on similar combination tools provided that you change the dimensions of the support bars (Fig. 6).

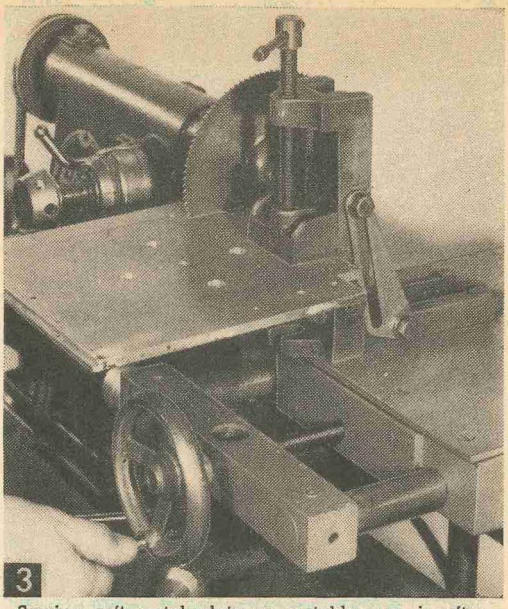
Construction requires accurate layout. You can build the entire project on your Shopsmith itself, provided that you improvise a drilling table, and a slow-speed attachment. Both will be useful for other metal, wood and plastic jobs later on.

Make the metal drilling table shown in Fig. 4, of ⅜-in. cold rolled flat steel plate. With your Shopsmith vertical, place the two 1″ support bars in the carriage. (For Mark II, or Mark V Shopsmiths, use 1¼-in. support bars.) Then place the steel plate on top of the bars resting flush against the carriage. Clamp firmly, and drill *two* of the $^{13}/_{64}$″ holes through the bars and plate, with a portable electric drill. Tap, countersink, and install the first two screws. This method guarantees better alignment and prevents the bars from shifting during the drilling of the other four holes. Drill the center hole, with a boring tool, or fly cutter working through from both sides.

The cross-feed (Fig. 6) requires that you drill or bore six 1″ holes in the square bars, which means you will need slower spindle speed (100-150 *rpm*) than is usually available on the Shopsmith. Another story in this handbook, "How To Bore the Big Ones," page 156, shows how to reduce spindle speed of an ordinary drill press.



The cross feed converts your Shopsmith into a light duty milling machine. This slot in an aluminum plate is cut by feeding slowly back and forth, with a 2-flute milling cutter held in a router chuck.



Sawing soft metal plate on a table saw is often dangerous because the work can slip and jam. The cross feed grips the work solidly for safe even cutting. Keep aluminum work cool with water, or soluble oil.

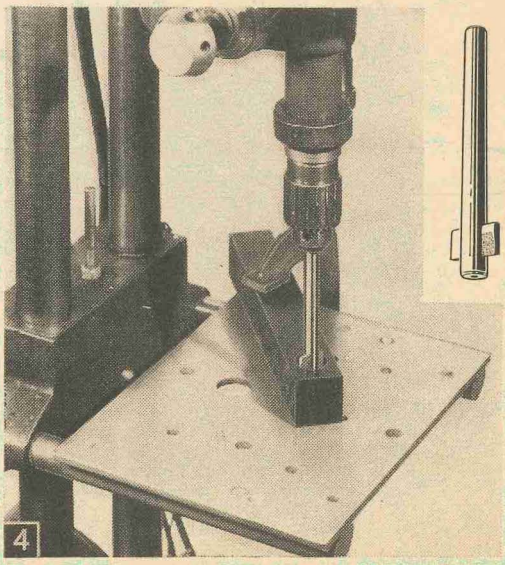
Slow speeds down to about 400 *rpm* can be obtained with a Shopsmith accessory originally offered, but no longer generally available (Fig. 7A). If you have this speed changer, you can reduce the speed to the 150 *rpm* range by substituting an 8 inch pulley for the regular headstock pulley, with V-belt to fit. Drill the pulley bore out to $1\frac{3}{16}$-in.

An alternate method is to build a jackshaft (Fig. 7B) which fits on one side of the Shopsmith. Any of these slow-speed modifications will prove useful not only for drilling, but other metal working jobs.

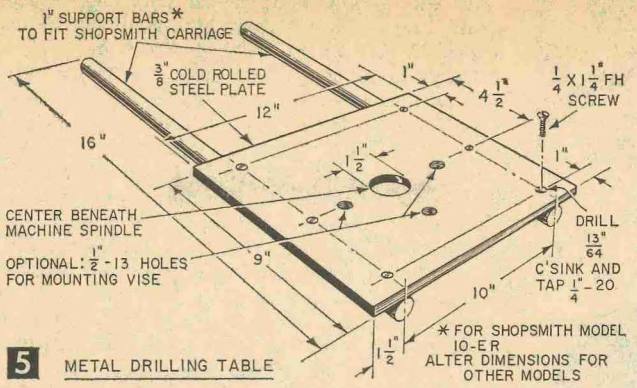
Cold rolled steel bars required for the attachment (Fig. 6) can be ordered cut to length from any steel warehouse. The sliding bearing blocks are made of Masonite Benelex "70" die stock, available from Masonite distributors and cutting services. Similar in composition to familiar hardboards, this material is tough and dense. It cuts like very hard wood, or plastic, but has no grain or tendency to split. Alternately, you can substitute regular 1-in. pillow blocks for the sliding portion and eliminate one step in construction.

Begin layout on one of the square bars. Use blue layout fluid, or any thin metal lacquer, and locate all the holes with a small center drill. Then enlarge the holes to ¼-in., drilling with a sharp new drill, using moderate speed and plenty of oil, with the work solidly clamped.

Using the first bar as a template, transfer the hole locations through to the second square steel bar, and also the sliding blocks, simply by starting the holes with the ¼-in. drill. Then enlarge the ¼-in. holes up to 1 inch using oversize blacksmith drills with ½-in. shanks. An alternate method of drilling large holes utilizes an "Econo-Bore" tool recently offered by DoAll Corporation, Des Plaines, Ill. The tool shown in Fig. 4, has a $15\frac{}{32}$" shank, which costs $4.35. The 1 inch cutter costs $1.50, and is interchangeable with other fractional sizes that fit the same shank.



Use a flat piece of steel plate to make this sturdy metal drilling table. Threaded holes are used to mount an adjustable vise, and are handy for improvising clamping fixtures.



5 METAL DRILLING TABLE

Using this tool, first enlarge your ¼-in. holes up to $15/32$-in. The Econo-Bore tip will follow right down cutting a precise 1-in. hole. But be sure to stop short of breaking through. Turn the work piece over and cut through from the other side. The 1-in. tool must be used at speeds around 100 *rpm*, with plenty of cutting oil.

Now, drill and tap the holes (Fig. 6) for the set screws, removing any inside burrs that may develop. The screw feed is an inexpensive ½ in.-13 threaded rod, available in hardware stores. It feeds through a threaded plate and is held at one end by a nut and collar. The handwheel can be improvised, or the one shown in Fig. 9 can be purchased in large hardware and mill supply stores. Ball bearing thrust washers provide a smooth screw action; however, several common washers placed at each end will work almost as well. Assemble the complete unit minus the attachment plate, and place it on your Shopsmith to establish the proper spacing.

If your sliding blocks tend to seize, it may be necessary to ream the holes slightly. Tighten the socket-head screws that hold each bar. You may want to weld the main support bars permanently in place to avoid any slight mis-alignment later. The unit should fit the Shopsmith perfectly, sliding in and out of the carriage holes freely.

Drilling of the holes in the table plate is optional depending on the kind of vise you plan to use. A Palmgren #000 drill press vise is shown in Fig. 1, and it is fastened through its bottom plate with a ½ in.-13 socket head screw. Extra holes and slots will enable you to mount other vises, and special fixtures. After you complete your cross feed table, you will find that you can quickly set it up to handle many different kinds of metal working jobs.

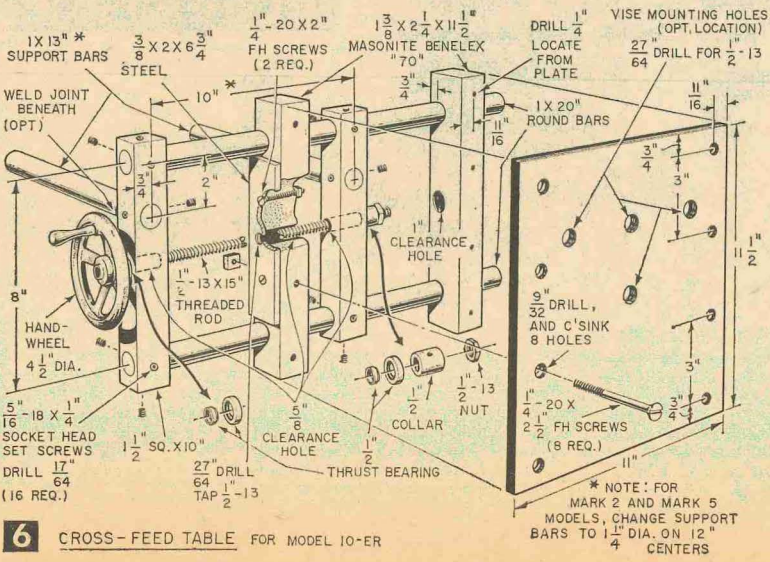
If you are used to working only in wood, take special note of metal-working safety precautions. While wood shavings and saw dust are quite harmless, metal chips and abrasive dust can cause painful eye injuries. In a hurry, it is all too easy to misplace your safety glasses, and operate your tools without eye protection. Improvise a plastic hood for your machine, or simply make a bracket, to hold a shield of safety glass, and bolt to the Shopsmith frame. Even then, wear the goggles whenever the machine is running, and stand away from the cutting line.

Cutting feed and tool *rpm* are more critical in wood than in metal. Usually the larger the cutting tool, the slower the speed. When milling (Fig. 2) avoid forcing

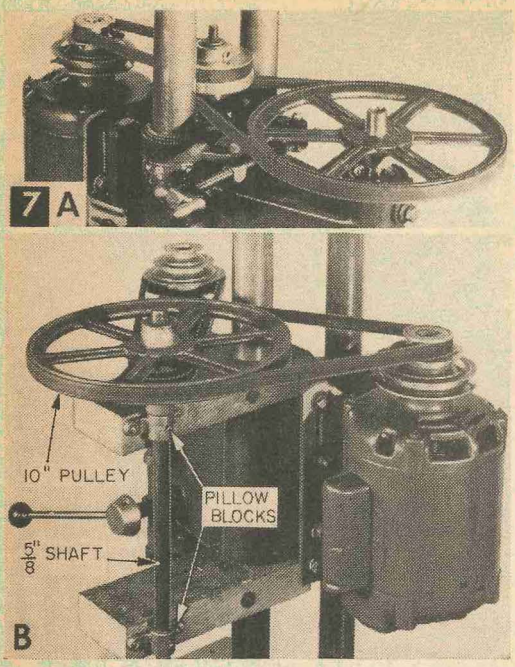
MATERIALS LIST—CROSS FEED TABLE

No. Req'd	Size and Description
2	1 x 13" cold rolled round steel bars *
2	1 x 20" cold rolled round steel bars
2	1½ x 1½ x 10" cold rolled square steel bars
2	1⅜ x 2¼ x 11" pieces Masonite Benelex "70" (cut from 1⅜" stock)
1	11 x 11½ x ¼" cold rolled steel plate
1	⅜ x 2 x 6¾" cold rolled steel plate
1	½"-13 x 15" threaded rod (Redi-Bolt or equal)
1	4½" dia. ½" bore handwheel (Chicago Die Casting #186NS)
2	½" unground radial thrust bearings (Boston Gear #5169)
1	½" collar & nut
8	¼"-20 x 2½" fh stove bolts & nuts
2	¼"-20 x 2" fh stove bolts & nuts
16	5/16"-18 x ¼" socket head set screws
	DRILLING TABLE
1	⅜ x 9 x 12" cold rolled steel plate
2	1 x 16" cold rolled round steel bars *
6	¼"-20 x 1¼" fh machine screws

* Use 1¼" dia. round bars for Shopsmith Models Mark II and V. See text.



6 CROSS-FEED TABLE FOR MODEL 10-ER



If you have a slow-speed attachment, (A) the 10 inch pulley on your headstock will give you the right speed for boring steel with the 1-inch Econo-Bore. The improvised jack-shaft (B) will produce same result. Higher *rpm* would cause this tool, or a large drill to chatter.

the feed, taking light repeat cuts deeper each time as you travel back and forth across the work. Trying to cut too fast will cause the tool to grab, or chatter, and it may even break. Milling cutters and routers should never be used in the Jacob's chuck supplied with the machine, since side strain may affect the accuracy. And don't forget to use the proper cutting fluids.

Use coarse grade *flexible* abrasive wheels for rough fast cutting (Fig. 9) and fine grain wheels for close small jobs. Avoid any brittle grinding wheel, or cutting stone, since they may shatter dangerously. Since wheels throw abrasive dust and small chips, a guard is necessary, (Fig. 9) plus glasses. Keep the work piece cool with fine water spray, and if your metal heats up, back out of the cut and allow the work to cool before continuing. Proper wheel speeds, as well as recommendations for using all metal working tools, can be found in manufacturer's literature.

Since metal chips and abrasive dust can harm the tubular ways of your Shopsmith, protect them with cloth covers, or the commonly available aluminum cooking foil.

Milling cutters and routing tools, as well as metal saws, are usually designed for one particular kind of metal. For example, aluminum generally requires wider, more open milling cutters with fewer flutes to allow stringy chips to clear, while cast iron is usually cut with a mill that has more teeth.

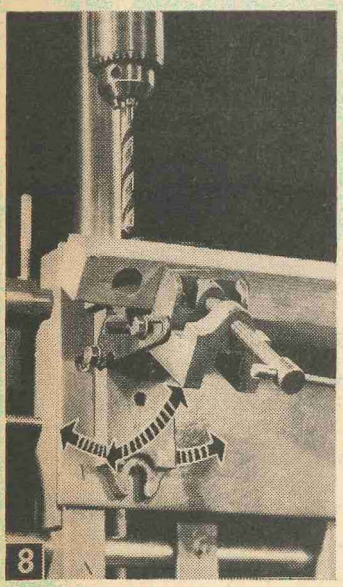


Fig. 8. The adjustable vise and cross feed give you a quick setup for drilling at any complex angle. At extreme angles, saw or chisel a spot on the work for locating the hole and starting the drill.

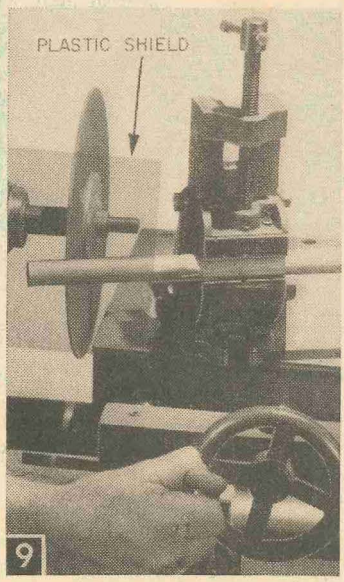


Fig. 9. Cut long lengths of conduit, metal tubing or bars with the flexible abrasive wheel. Always stand away from the work. A safety guard can be made of clear plastic. The bed of the machine should be protected from abrasive dust and chips.

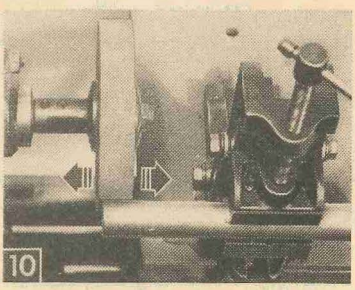


Fig. 10. Grind a flat on a shaft by feeding the wheel slowly back and forth with the headstock quill. Use a guard and be sure to wear glasses. Let the speed do the work, feeding with light even minimum pressure.

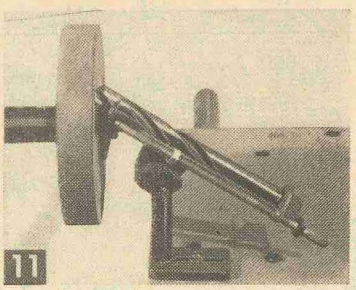
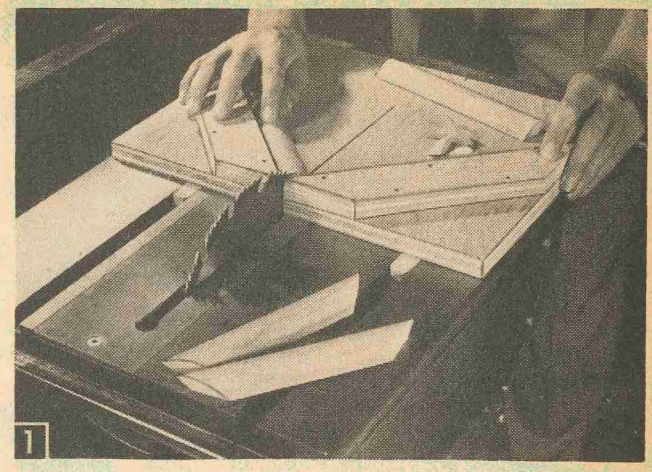


Fig. 11. Sharpening drills of various sizes, as well as other tools, is simplified with completely flexible locating adjustments provided by the cross-feed and the Shopsmith.



Simple sliding-platform jig provides perfect miters for frames every time when parts are placed accurately. This one is designed for pieces precut to exact length.

Four Sliding Jigs

Insure Perfect Miters

By R. J. DeCRISTOFORO

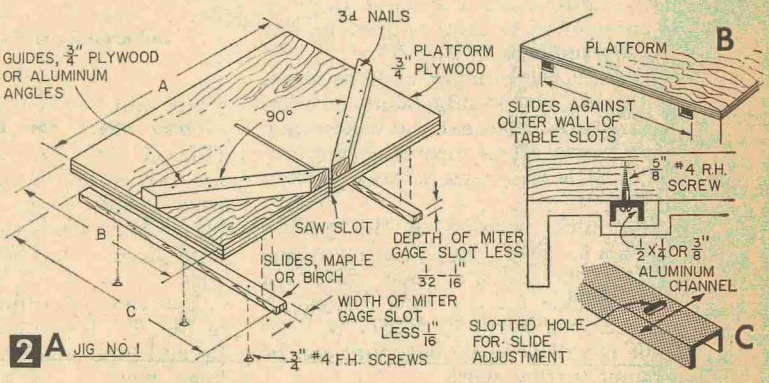
IT'S easy to cut miters on your bench saw, but making them accurate enough for framing joints is another matter.

Your mitering troubles are over, however, if you build one or more of these simple jigs designed to give you a perfect cut every time. Because the jigs *move with the work* as in Fig. 1, there is no saw readjustment for right- and left-hand miters and the problem of "saw blade creep" (tendency to pull the work) is eliminated.

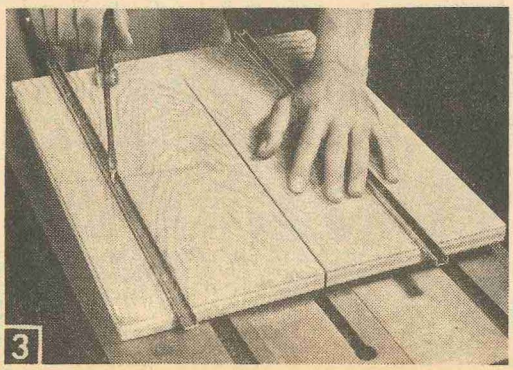
Work carefully in making any of these jigs. Though simply constructed, they must be right in all details. The least little deviation will destroy their effectiveness. Sand each part smooth before assembly.

General Construction.

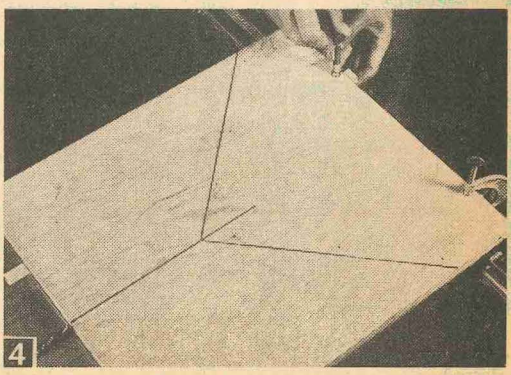
For the platform and most other pieces, ¾-in. fir plywood is adequate, but be sure it is sufficiently dry so that it will not warp. If your saw is very small, substitute ½-in. plywood. Make width A in Fig. 2A conform to width of your saw table as in Figs. 1 and 9. Depth B in Fig. 2A of jig # 1



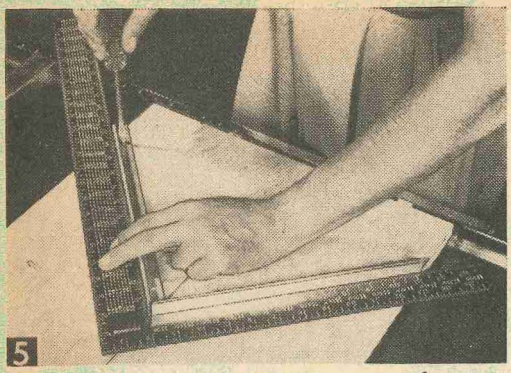
2A JIG NO. 1



Aluminum channel is good ready-made material for platform slides. Hacksaw strips to protrude 1 in. beyond each end of platform and file edges smooth.



It's important to align slides perfectly against outer edges of table slots. Clamp in position to platform, turn work over and fasten securely.



Carpenter's square helps maintain exact 90° angle for guides.

represents distance from front edge of saw table to front edge of blade when set at 2-in. height. For each of the other jigs described later, this depth B dimension equals the distance from front edge of table to center-line of blade arbor.

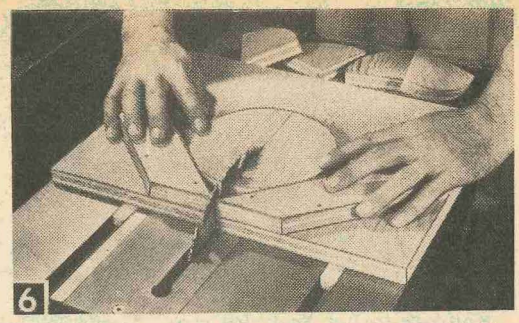
For slides, use hardwood to fit miter gage slots of your saw table or, if you want to avoid this job, try ½-in.-wide aluminum channel ¼ to ⅜-in. deep as in Fig. 3. Make slides 2 in. longer than depth of platform (C in Fig. 2A). Be sure to position slides so that outboard sides fit snugly against outboard sides of table slots as in Fig. 2B. There should be a smooth sliding motion without any side play. For adjustment to assure a good fit, slot the attachment holes as in Fig. 2C.

Don't trust a ruler to mark slide position. It's better to set slides in table slots, position platform and clamp slides exactly where they belong as in Fig. 4. Then turn over platform and fasten slides with screws before releasing clamps.

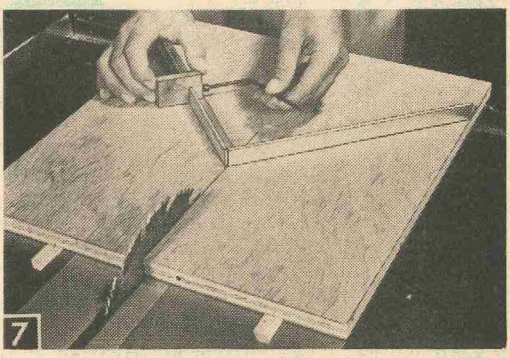
Next, determine position of the guides, which depends on which jig you are working on and cut saw slot, using a blade which will always be available for use with the jig. A hollow-ground combination blade is suggested since it will produce cuts that can be joined without further work.

For guides, use ¾-in. plywood, hardwood or aluminum angle, with length depending on angle desired and distance from saw cut to platform edge. Lay out angle with a protractor, using saw slot as center-line. To assure accuracy, maintain correct angle with a large carpenter's square when securing guides in position with nails or screws, as in Fig. 5.

As soon as finished, protect each jig from accuracy-destroying moisture with a resin sealer and two or more coats of shellac.



Jig simplifies cutting of discs into halves, quarters and —by positioning quarters point first—even eighths.

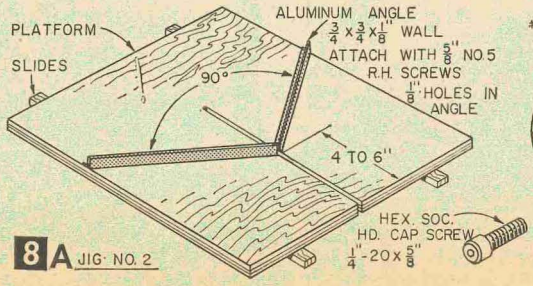


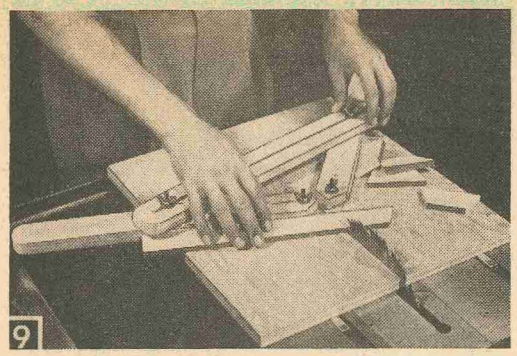
Intended for stock of any length, this jig has an adjustable stop block on aluminum angle guide for fast and accurate cutting of many similar pieces.

Fixed Miter for Precut Pieces. Jig # 1 (Figs. 1 and 2A), set for a 45° miter, is good for fast work in picture frame production when using pieces precut to exact length. Made correctly, it will give you one or a hundred pieces cut exactly 45°—it can't be otherwise.

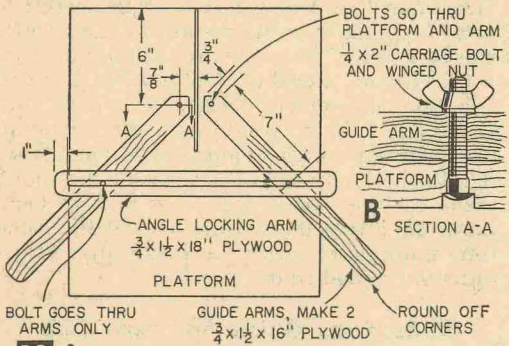
You can also utilize this jig to cut discs as in Fig. 6. Merely hold a disc in place on the jig and push the jig, not the work. This will keep work from turning and binding the blade, which would result in a kickback.

If saw blade projection is set just a fraction above the platform surface, you can cut cross-diagonals on the ends of square or





Adjustable-guide jig saves time where work frequently requires segment cutting at different angles.



10 A JIG NO. 3

round pieces for mounting on the spur center of a wood lathe.

Miter at Any Point on Stock. Jig #2 (Figs. 7 and 8A) guarantees accuracy of the miter, but leaves exact length of the piece up to the operator. To speed cutting of small frames, you can fit this jig with a stop block as in Fig. 7, made of scrap hardwood or an easily-worked, non-ferrous metal such as aluminum or brass. For aluminum angle guides with ⅛-in. wall, shape the block to dimensions given in Fig. 8B.

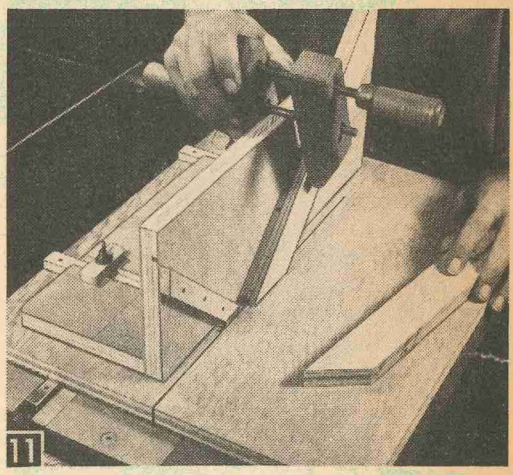
After cutting one piece to exact length, set stop block to it and you are ready to shape several similar pieces from one length of stock, turning over the stock after each cut so miters will face correctly. If you're working with a shaped molding, attach a stop block to each guide to permit the left- and right-hand cuts.

Adjustable Miter for Segment Cutting. Guide angles of the above jigs need not be set at 45°. Merely change the guides to suit if you have a great deal of segment cutting to do at one different angle.

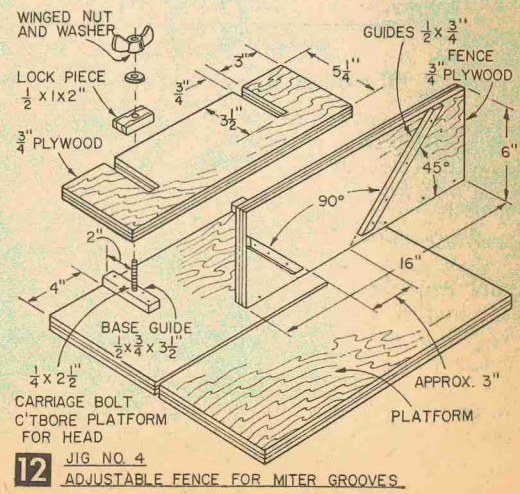
Jig #3 (Figs. 9 and 10A) adjusts to whatever angle you require, two different angles or two similar angles. Using the same type of platform and slides as for Jig #2, cut guide arms and an angle locking arm as in Fig. 10A. Attach the carriage bolts and winged nuts as in Fig. 10B. After determining exact degree of the miter, lock all four winged nuts to hold jig rigid. If you need a stop, cut the first piece to length and drive a small finishing nail or staple part way into side of the guide arm against edge of the piece.

Fence for Miter Grooves. Jig #4 (Figs. 11 and 12) is ideal for forming spline grooves in miter cuts, because it eliminates the danger of tilting and wobbling which could very likely happen when such cuts are made freehand. The fence is adjustable to handle many stock thicknesses.

Use maple strip for guides and cut other parts out of plywood to dimensions given in Fig. 12. You can add to the utility of this jig by making the guides adjustable or replaceable to change angle of the cut. You can even cut tenons by providing a guide to hold the work perpendicular to the table.



Adjustable fence on platform forms spline grooves in miters. To make cut, merely set stock against the guide, clamp in place and move jig past the blade.

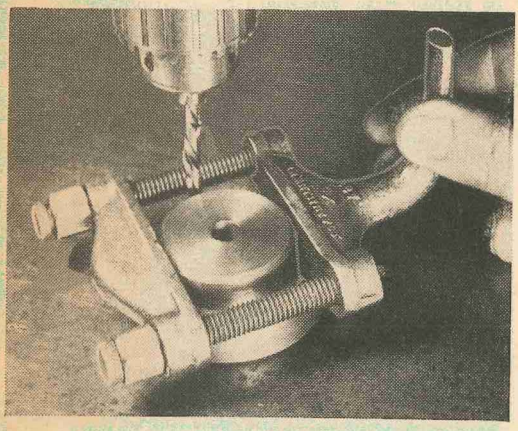


12 JIG NO. 4 ADJUSTABLE FENCE FOR MITER GROOVES

SHOP KINKS

Lathe Dog Drill Press Clamp

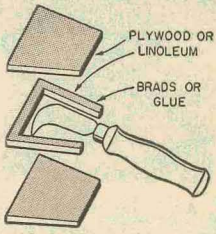
• A large lathe dog makes a handy clamp for holding round work on the drill press table. If you hold the tail of the dog with your free



hand, you can safely counteract the torque of small drills up to ¼-in. For larger sizes, use more solid clamping methods.—H. J. GERBER.

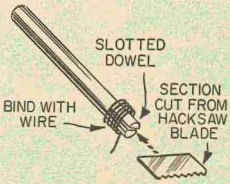
Pocket Sheath for Linoleum Knife

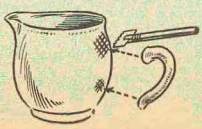
• To carry a sharp linoleum knife safely and conveniently, make a sheath from three pieces of thin plywood, or heavy linoleum. Cut out the parts to fit around the knife as shown in the sketch and assemble with brads or glue.—G. E. HENDRICKSON.



Ceramic Scratch Tool

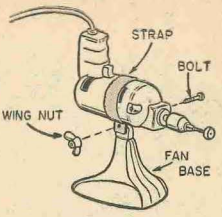
• A small section of a hacksaw blade inserted into a slot cut in the end of a strip of wood or dowel makes a very useful ceramic tool. A few strokes with this tool quickly prepares the surface of pieces to be joined together. Use fine and coarse-toothed hacksaw blades to make up a variety of scraping and decorating tools.





Adjustable Holder Angles Drill

• A discarded electric fan base makes an adjustable holder for your electric drill that will enable you to work with two hands, with the tool supported at any convenient angle. Make the strap of scrap tin, or sheet metal, and use a bolt and wing nut to fasten it to the base.—J. A. COMSTOCK.

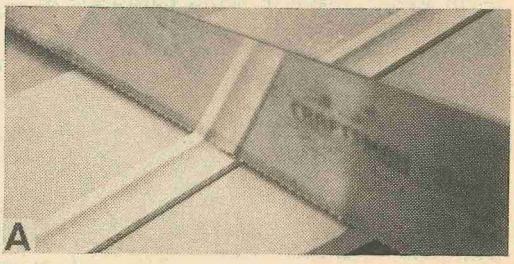


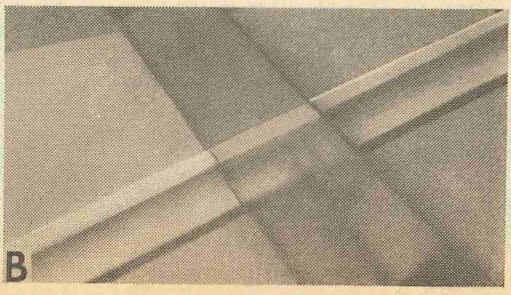
Metal Fluxing Technique

• When soldering metal surfaces (especially aluminum), soldering flux is often needed to retard oxidation of the metal until the solder can be applied. A good way to apply the flux is to "charge" a wad of steel-wool with it and rub the metal surface briskly for several minutes. The rubbing produces a small amount of friction heat which melts the flux and flows it into the many tiny scratches in the metal made by the steel-wool. This fluxing technique roughens the surface and at the same time thoroughly saturates it with flux assuring a very good solder bond.

Reflections Guide 90° Saw Cut

• You can saw a right angle without marking it first with square and pencil, simply by watching the reflection of the edge of the board on the shiny surface of the saw. Move the saw handle (A) until the reflection lines form a straight line (B). The better the light, the better the reflection. A light wipe of oil on the blade helps you to see the reflection and improves the cut too.—N. ENGELS.





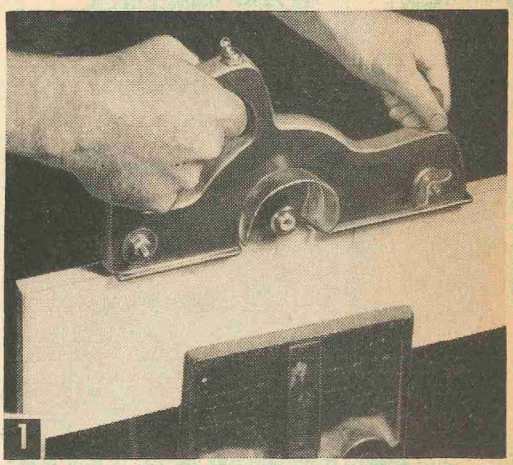
Powered Edge Planer from an Old Vacuum Motor

A ⅙-¼-*hp* vacuum-cleaner motor of the universal *ac-dc* type powers this handy tool for planing sawed lumber edges smooth and square (Fig. 1). You can dress stock up to ⅞-in. thick with the 3-lip, factory-made cutter shown in Fig. 2.

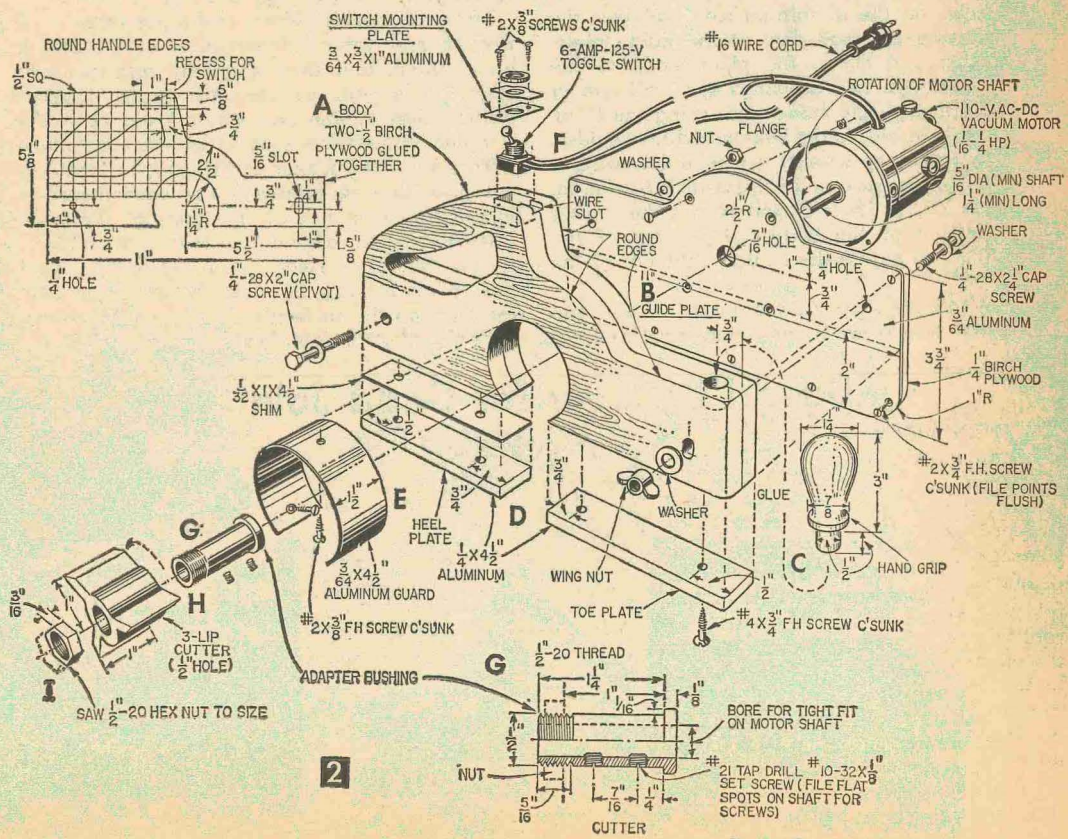
First, secure the motor from a vacuum-cleaner repair shop. It should have an attaching flange similar to that shown in Figs. 2 and 3, and a 5/16 in. diameter shaft at least 1¼ in. long without a threaded end. Check the motor shaft to see that it runs smoothly and without shaft wobble or end play. Mine cost $2 and I reconditioned it with new carbon brushes.

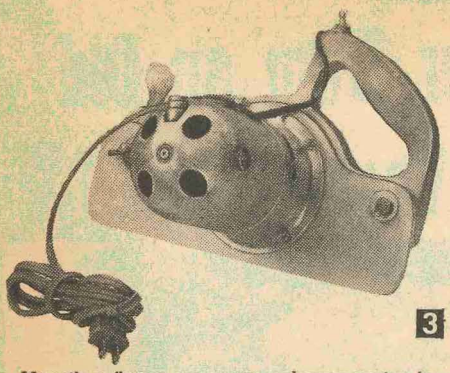
Because the mounting flange diameter on these motors varies in size with different makes, check the 2½-in. radius on the plane body (Fig. 2A) and guide plate (Fig. 2B) to see if it is large enough. The radius should be ¼ in. larger than the radius of the motor flange.

First cut out the plane body from two pieces of ½ in. birch plywood glued together. Drill a ¼ in. hole at the back and a 5/16 in. elongated slot at the front. Then recess the edge of the handle for a toggle switch and cut a notch for the pre-



One pass of this planer across the edge of a board will remove 1/32 in. of stock and leave a perfectly flat and square edge.





Mounting flange on vacuum-cleaner motor is bolted to guide plate of portable planer body.

MATERIALS LIST—POWER PLANER

Amt.	Req.	Size and Description	Use
1		universal-type, ac-dc, 1/8-1/4 hp vac motor	
1		6-amp., 125 v. toggle switch	
12 ft		#18 plastic-covered line cord with plug	
2		1/2 x 5 1/8 x 11" birch plywood	body
1		1/4 x 5 1/4 x 11" birch plywood	guide plate
1		3/64 x 5 1/4 x 11" aluminum sheet	guide plate
1		1 1/4" dia. x 3 1/2" hard or soft wood	hand grip
2		1/4 x 1 x 4 1/2" flat aluminum	heel and toe plates
1		1/32 x 1 x 4 1/2" aluminum	heel-plate shim
1		3/64 x 1 1/2 x 4 1/2" aluminum	cutter guard
1		3/64 x 3/4 x 1" aluminum	switch mounting plate
1		1/2" hole x 1" blade 3-lip shaper cutter	
1		5/8" dia. x 1 3/8" mild steel	adapter bushing
1		1/2"-20 hex nut	attachment nut
2		#10-32 x 1/8" set screws	
12		#2 x 3/8" fh screws	
4		#4 x 3/4" fh screws	
1	each	1/4"-28 x 2 1/4" cap screw with washers and wing nut; 1/4"-28 x 2" cap screw with washers and nut	
4-6		fh screws and nuts to fit motor-flange holes	

wired switch leads (Fig. 2F). After turning the hand grip (Fig. 2C), drill a 1/2-in. hole in the top, front of the body and glue the hand grip to the body.

The guide plate is made up of sheet aluminum and 1/4-in. plywood fastened together. Lay out the aluminum as in Fig. 2B, fasten it to the plywood with four #2 x 3/8 in. *fh* screws at the corners and cut out both pieces at once on a jigsaw. Locate and drill the 7/16-in. hole for the motor shaft, and position the motor on the guide plate, centering the shaft in the 7/16-in. hole. Then drill holes for motor mounting bolts, locating them from the holes in the motor flange. Countersink these holes on the aluminum side and bolt the motor to the plywood side of the guide plate. Now, align and clamp the plane body to the guide plate with two C-clamps and drill two 1/4 in. holes through the guide plate using the 1/4 in. hole and 5/16-in. slot in the body as drill bit guides.

Insert 1/4-in. cap screws in the holes using a wing nut on the screws going through the 5/16 in. slot as in Fig. 2 The slot will permit the raising and lowering of the body independent of the guide plate to adjust the depth of the cut of the planer.

From 1/4 x 1-in. bar aluminum cut a heel and toe plate, and from 1/32-in. sheet aluminum or brass cut a shim for the heel plate as in Fig. 2D. Drill and countersink #33 holes in the plates for #4 x 3/4-in. *fh* screws and attach the plates to the bottom of the body. The thickness of the heel-plate shim determines the depth of cut, edge of cutter being adjusted level with bottom of the heel plate. Next, make a cutter guard from 3/64-in. aluminum and attach it to the body with three #2 x 3/8-in. *fh* screws countersunk flush.

Make the adapter bushing as in Fig. 2G from mild steel on your lathe to fit the cutter bore snugly. Use a standard #20 x 1/2-in. hex nut and saw it off to 3/16-in. thickness to secure the cutter on adapter bushing (Fig. 2I).

Make the toggle-switch mounting plate as in Fig. 2F and, after assembling it to the switch, attach the plate to the plane body with two #2 x 3/8-in. *fh* screws countersunk flush. Connect switch leads to line and motor leads as in Fig. 2. Solder splices and wrap with electrician's tape.

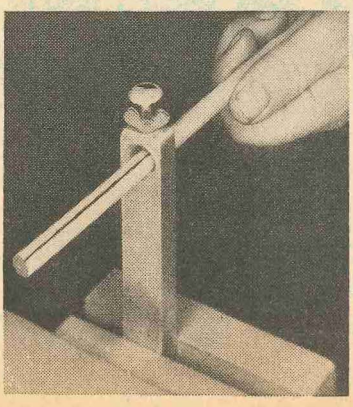
To set up the planer for the 1/32 in. depth of cut, place the heel plate on a flat wooden surface, loosen the wing nut at the front of the plane body and set the edge of one of the cutter blades on the wooden surface. Then tighten the wing nut. When planing the edge of a board, place the toe plate on the surface to be planed and slowly slide the plane across the work.—CARL S. BATES.

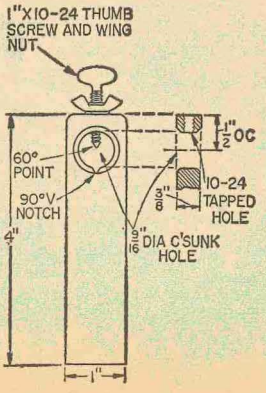
Dowel Groover for Good Joints

WHEN building or repairing furniture which has dowel joints, you should use grooved dowels. The grooves provide an escape path for trapped air and glue, lessening the chances of split work.

You can make straight-line grooves in dowel stock using the groover shown in Fig. 1. Follow details in Fig. 2 for making the groover.

To use it, you push the dowel through the hole and the pointed thumb screw, set for a 1/32-in. cut and tightened with a locking wing nut, does the rest. Be sure to make grooves on two sides.—F. HEGEMEYER.



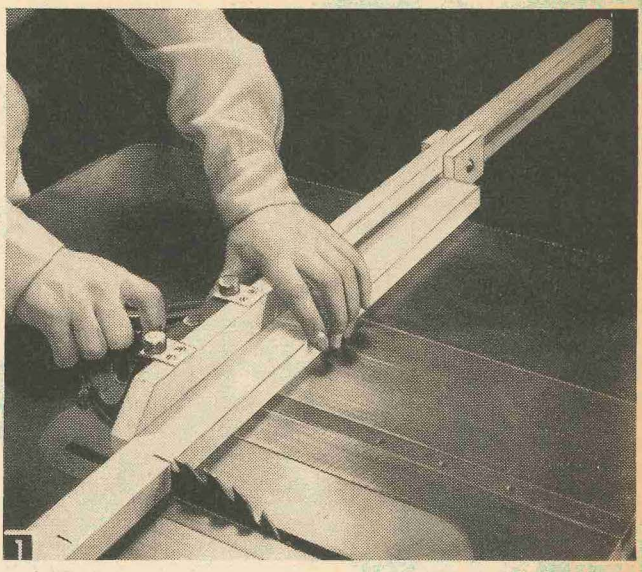


"Duplicating" on Your Circular Saw

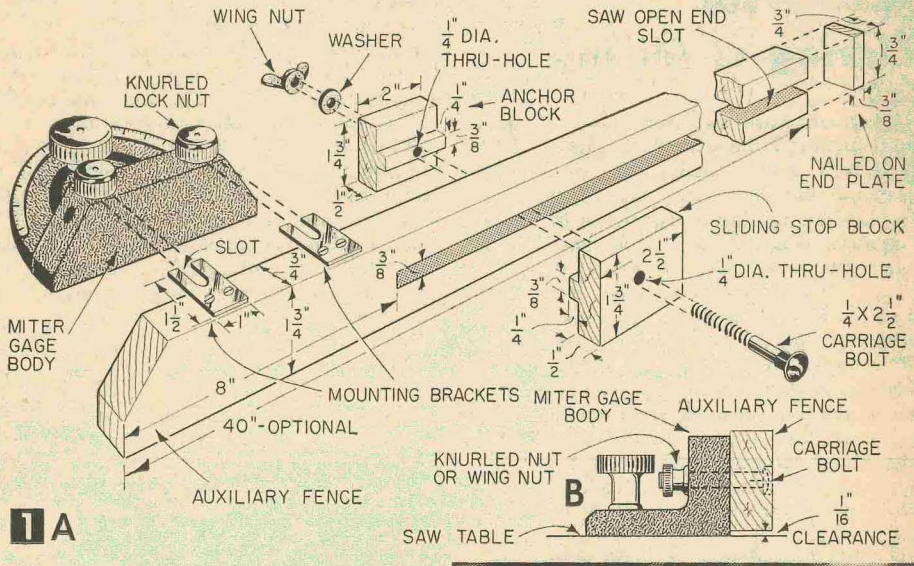
CUTTING stock accurately to duplicate lengths can be a fussy, time-consuming job, unless you have these unique fixtures. Figs. 1 and 1A show the fixture used to "duplicate" lengths ranging from about 9 to 38 inches. You can mount it on the miter gage body as in Fig. 1A.

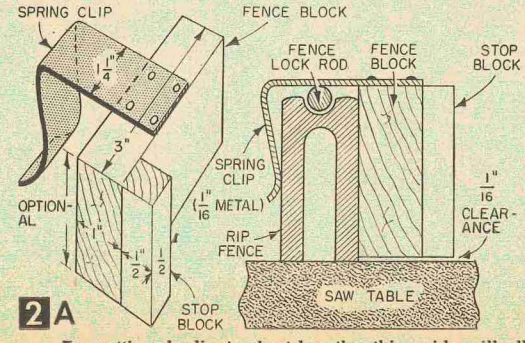
If your miter gage doesn't have the knurled lock screws (which are intended to hold stop rods), use the thru-bolt arrangement (shown in Fig. 1B) for mounting the auxiliary fence to the miter gage body.

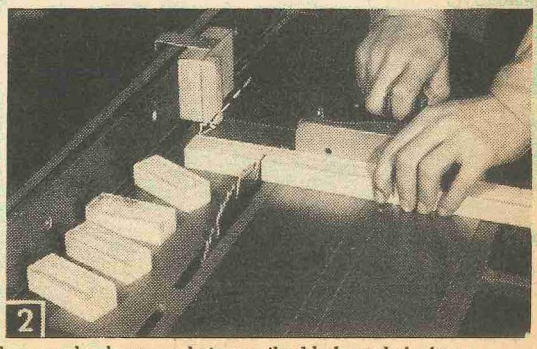
When you need to cut duplicate stock less than 9 in. long, then use the clip-on guide in Figs. 2 and 2A. —F. HEGEMEYER.



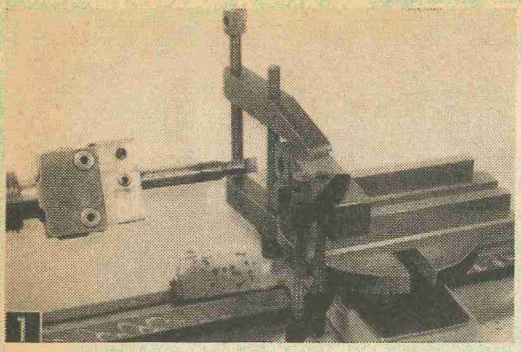
Sliding stop block (see arrow) adjusts easily and quickly to correct distance from saw blade, enabling you to cut exact duplicate lengths of stock.



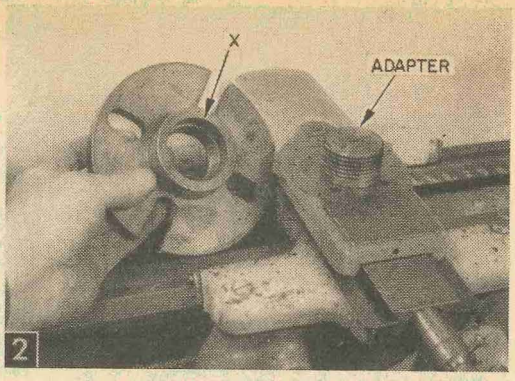




For cutting duplicate short lengths, this guide will allow ample clearance between the blade and rip fence.



Instead of rotating the workpiece on the headstock spindle it is clamped to the lathe face plate which is fastened to the cross slide by the special adapter. Boring bar is held and rotated by headstock and the workpiece fed by carriage movement.



Since surface X on lathe face plate will bear against machined surface on cross slide, surface X must be machined parallel with working face of face plate.

Lathe Face Plate Adapter

Holds Work for Boring or Milling

YOU can increase the versatility of your metal-turning lathe with this adapter which will enable you to fasten the face plate to the cross slide and then clamp the workpiece to the face plate for milling or boring as in Fig. 1.

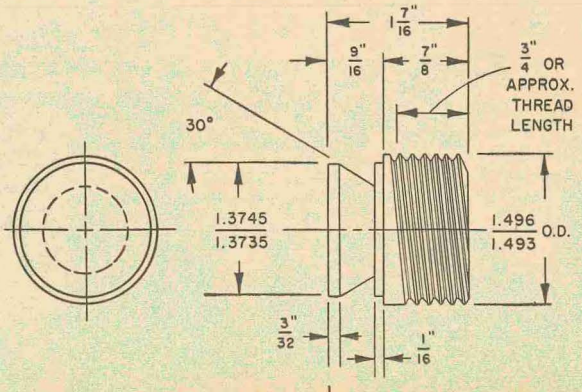
The adapter (Figs. 2 and 3) is made to fit snugly into the pivot hole into which the compound was seated on the cross slide. The lower portion of the adapter is turned to duplicate the pivot protrusion on the bottom of the compound slide. The screw thread on the adapter is a duplicate of the screw thread on the spindle nose of the lathe headstock spindle so that it will fit the internal thread of the lathe face plates. Dimensions given in Fig. 3 are for use on a 9-in. South Bend lathe. For other makes of lathes, change the dimensions to suit.

To assemble the adapter to your lathe, remove the compound slide from the cross slide, and then seat and lock the adapter in its place (Fig. 2). The face plate must, of course, be turned true on its working face and be screwed on the adapter tightly so that its rear shoulder, which must also be faced off parallel with front face, is solidly seated against the top surface of the cross slide (Fig. 2).

Workpieces are located in position by blocking them up on parallel bars or shims and held in place by clamps. Cutting tools used to machine the work are held and rotated in the headstock spindle as shown in Fig. 1 where an adjustable boring head, held in the tapered socket of the head spindle, is being used to finish bore a hole in a piece of steel which has been previously drilled in this same set-up.

This simple adapter will permit you to duplicate, to some extent, the movements of a milling machine in that two accurate feeding movements, either by hand or by power, are available for use. The carriage feed along the bed is used when drilling or boring and the cross slide for accurate location of a series of holes or for feeding while face milling. Large, through holes can be bored by using an adjustable cutter boring bar set up between lathe centers.—H. J. GERBER.

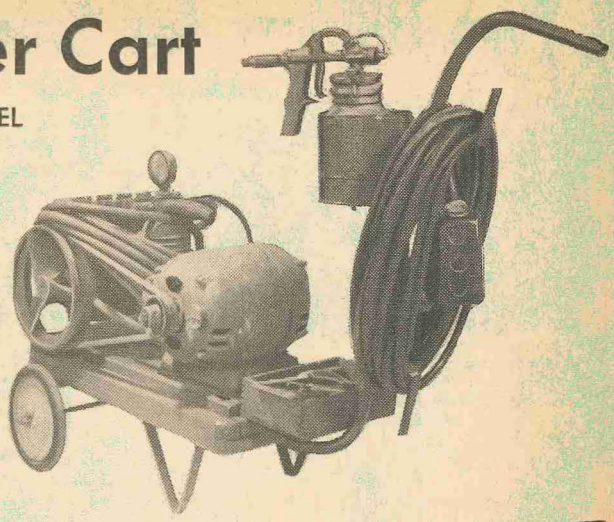
ADAPTER BELOW WILL FIT SOUTH BEND 9" LATHES. FOR OTHER MAKES THREAD TO SAME SIZE AS HEAD SPINDLE NOSE. FOR PORTION WHICH SEATS IN HOLE IN TOP OF CROSS SLIDE MEASURE PROTRUSION ON BASE OF COMPOUND



THREAD 1/2 - 8 USE LATHE FACE PLATE AS GAGE FOR PROPER FIT OF THREAD

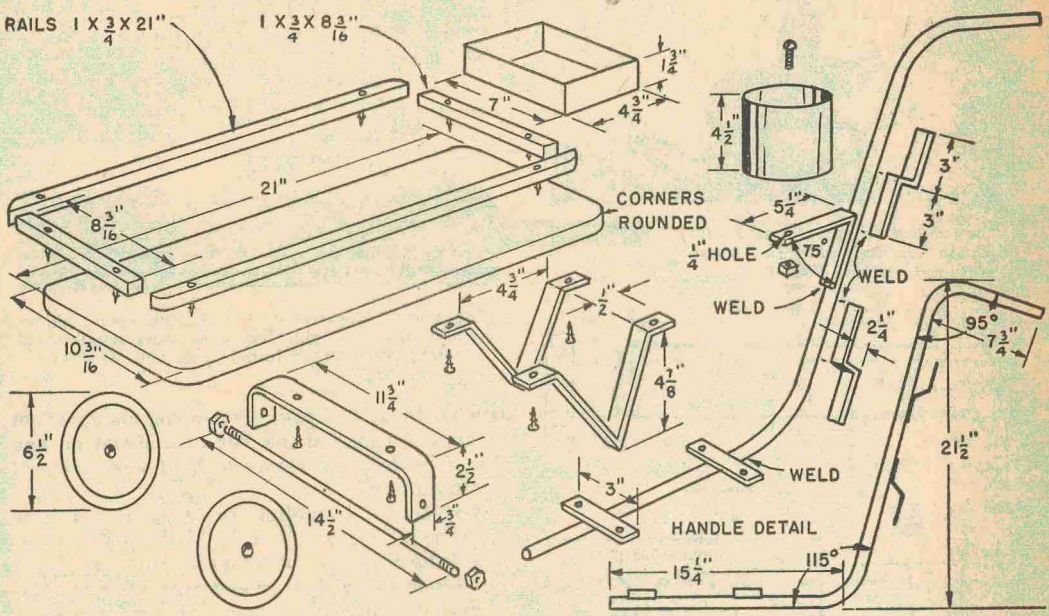
Paint Sprayer Cart

By EDWARD J. BICKEL



MATERIALS LIST—PORTABLE PAINT SPRAYER CART

No. Req'd.	Description	For
1 pc.	44¾" (long) ⅜" black pipe	handle
1 pc.	14½ x 5/16" rod	axle (rod)
1 pc.	16¾ x 1½ x ¼" strap iron	axle support
2 pcs.	12 x ¾ x ⅛" strap iron	front support
2 pcs.	3 x ¾ x ⅛" cleats strap iron	cross pc.-handle
1 pc.	8 x ¾ x ⅛" strap iron	spray-gun support
2 pcs.	8½ x ¾ x ⅛" strap iron	wire support
1 pc.	21 x 10 3/16 x ¾" plywood	body
1	2-lb. coffee can	sprayer holder
2	6½" dia. wheels	
2 pcs.	21 x 1 x ¾" wood	rails
2 pcs.	8 3/16 x 1 x ¾" wood	rails
	thin boxwood	tray
1	¼-20 bolt and nut misc. screws, nuts	



HERE is a compact cart that carries about the small paint spraying compressor and its attachments with a minimum of effort. It will support the compressor while operating without creeping. Vary the dimensions to suit the base of the unit. The bed of the cart is a 1-in. maple board or ¾-in. plywood. Four rails about the edges of the bed hold the base of the compressor from shifting. Support the axle by heating strap iron and hammer into a U shape then drilling four 5/16-in. holes. Thread the axle at each end for cap nuts. Bend the strap iron for front supports into a V shape with the ends bent horizontally and drilled for screws.

Bend the handle pipe with a heavy hammer in a vise or over an anvil. Weld the cleats to the handle for attaching to the underside of the cart. Weld the clips for the extension wire and the supports for the spray-gun to the handle. Hold the spray-gun in a 2-lb. coffee can cut down and the edges turned inward. Hold the can to the support with a ¼/20 bolt and nut. Screw a small open tray of thin boxwood across the front of the bed to hold tools.

Non-Abrasive Aluminum Polish

• To make a non-abrasive cream for removing stains from aluminum cookware, grate 1 bar of white soap into 2 cups of hot water, then heat to a jelly. Add 2½ oz. of household borax and recook the mixture until the jelly stage is again reached. Remove from heat, and beat with an electric mixer at low speed until cool. Blend 1 oz. glycerine into the mixture then 1 cup cold water. Beat the entire mass until fluffy. This recipe makes 4 pts. of polish which should be stored in sealed jars until used. It is most effective when used with very fine steel wool.

Two Holders for Small Boring Bars

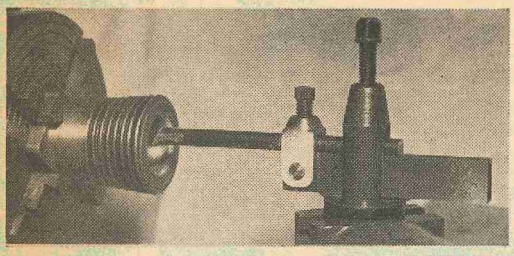


Fig. 1. Swing clamp with set screw hold round bars in a V-groove along top or square tools in groove on opposite edge, Tool A.

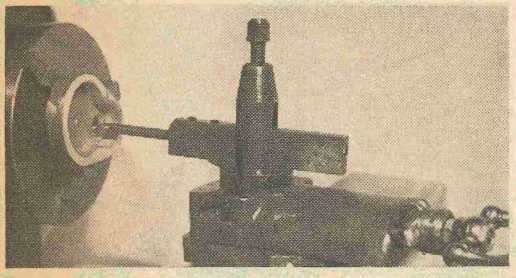
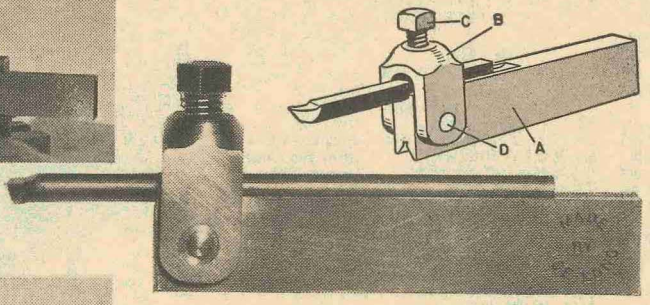


Fig. 2. Boring model engine casting with round boring bar clamped in easily constructed holder, Tool B.

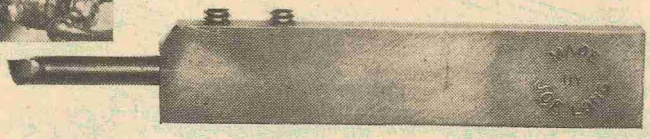
BORING on the lathe with small diameter boring bars or tools shaped from drill rod will be easier with either of these holding tools, constructed by J. B. Long. The swing clamp (Tool A) grips a round shank bar in a V-slot on one side of holder or reverses to hold a square tool in a flat groove.



MATERIALS LIST

TOOL A
- A—3/8x7/8x4 1/2" cold rolled steel
- B—3/4x3/4x1 1/2" cold rolled steel
- C—3/8"—16x3/4" set screw
- D—1/4x3/4" drill rod

TOOL B
- Cold rolled steel 3/8x7/8x4 1/2"
- 2 Allen set screws 1/4"—20x3/8"



Top photo: Close-up of Tool A with swing clamp. Bottom photo: Simpler Tool B showing round shank boring bar clamped in hole with two set screws.

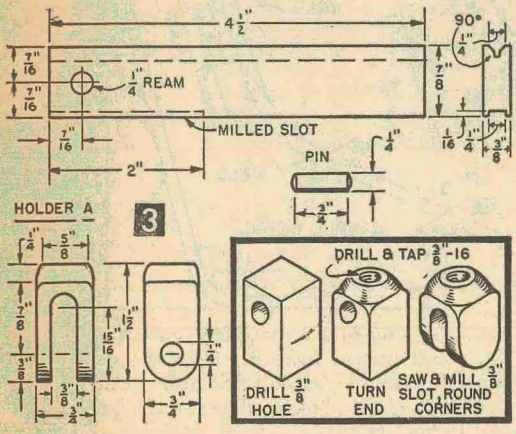
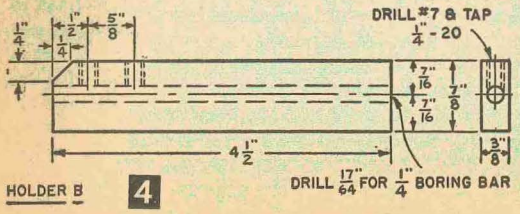


Fig. 3. Make the swing clamp by first drilling 3/8 in. hole at top of slot, chuck and center piece in 4-jaw chuck, shape end, saw away most of material before milling out 3/8 in. slot. Drill through clamp and body and ream to 1/4 in. for close fit with pin.

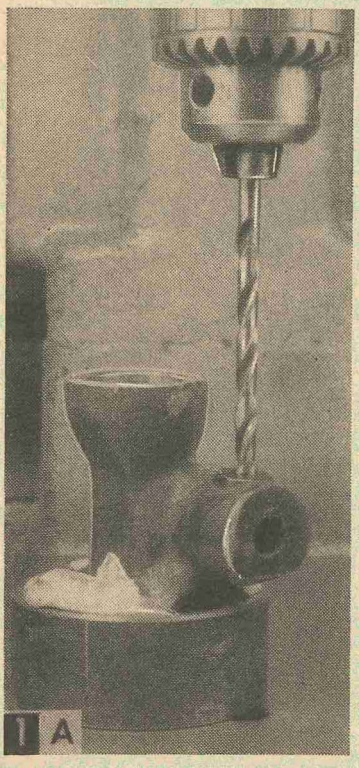
Start Tool A by milling the 90° slot along the entire body length with a double angle cutter or by cutting the slot on a shaper. Mill the slot on the bottom using a 1/4 in. end mill while work is clamped in lathe attachment. Follow the steps in Fig. 3 for machining the swing clamp. Drill and ream a 1/4 in. hole through the swing clamp and bar together for a close fit with the pin. Use a 3/8 in. set screw through the top of the clamp to hold boring bars.

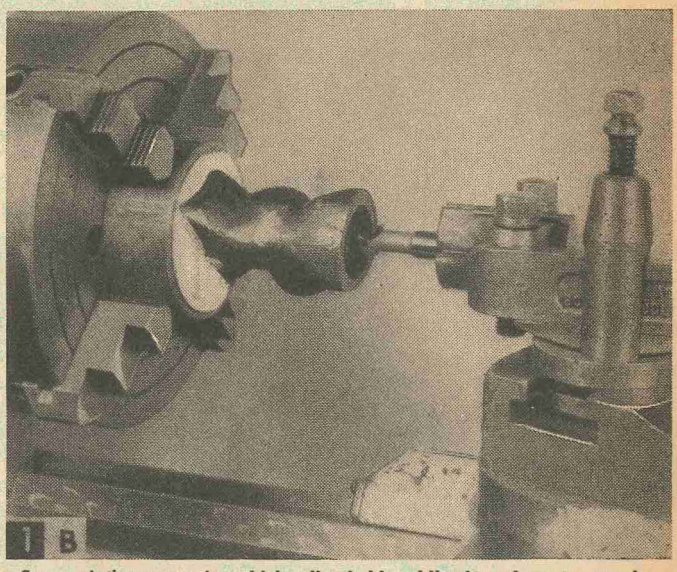
Make Tool B from a chunk of cold rolled steel. After machining bar to dimensions shown in Fig. 4, lay out hole location. Chuck and center the body in a 4-jaw chuck, and center-drill for the hole. Drill 17/64 in. hole half way through the body, reverse in chuck and recenter, and drill through from opposite end. Drill and tap body for the two Allen-head set screws, Fig. 4.

If Tool A should ride too high in your tool post for the boring bar to line up for deep hole boring, cut out a slot in the bottom edge the length of rocker deep enough to support bar slightly above ring on tool post.



Making Chucks and Drill Fixtures for Irregular Shapes

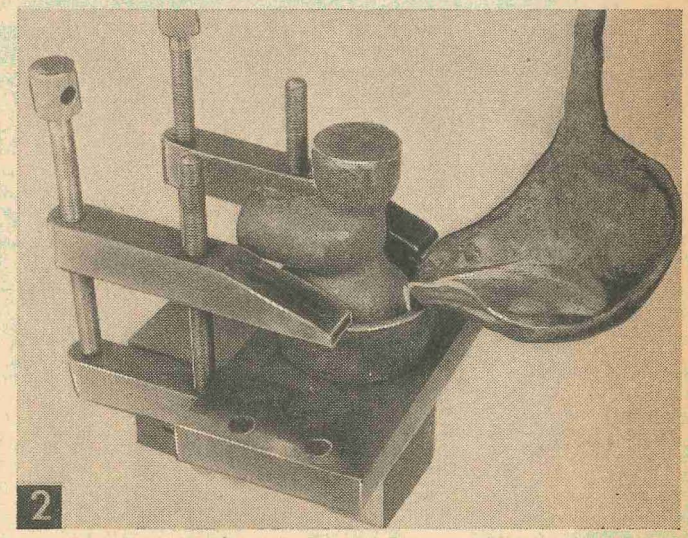




Some of the ways in which alloy-held, oddly-shaped parts can be machined.

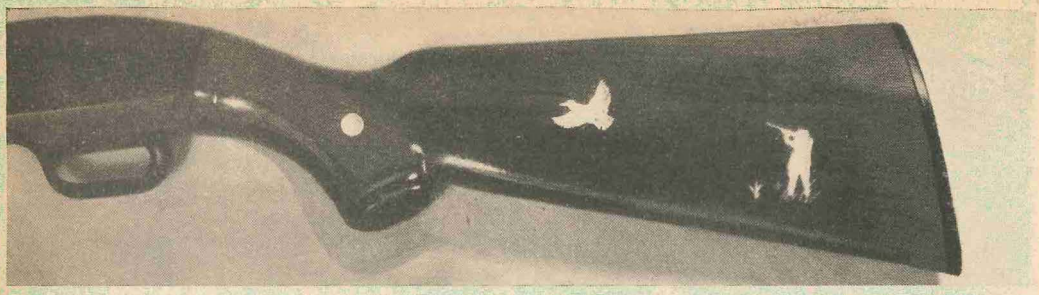
ODDLY shaped or delicate metal objects that cannot be held in a vise or chuck are easily machined (Figs. 1A and B) when partially embedded in *Cerro-Matrix,* a metal alloy with a pouring temperature range of 300-350°F.

While the problems presented will differ with each job, the method followed in machining the small, delicately skirted iron castings shown in the accompanying illustrations will show the basic procedure. First, a number of rings or *chases* of appropriate size were machined from steel tubing, then clamped to a flat steel plate and each casting seated on the plate inside one of the chases. The space between the chase and the casting was then filled with molten Cerro-Matrix (Fig. 2), which may be heated in a ladle with a torch, over the kitchen gas range or in an oven. When cool, the units were then easily positioned for lathe and drill press operations as in Figs. 1A and B. This soft alloy expands slightly upon cooling and will therefore hold the casting securely in the chase for working.



Chase clamped to flat steel plate. Casting is seated on plate inside chase. Heated Cerro-Matrix is then poured into space between chase and casting.

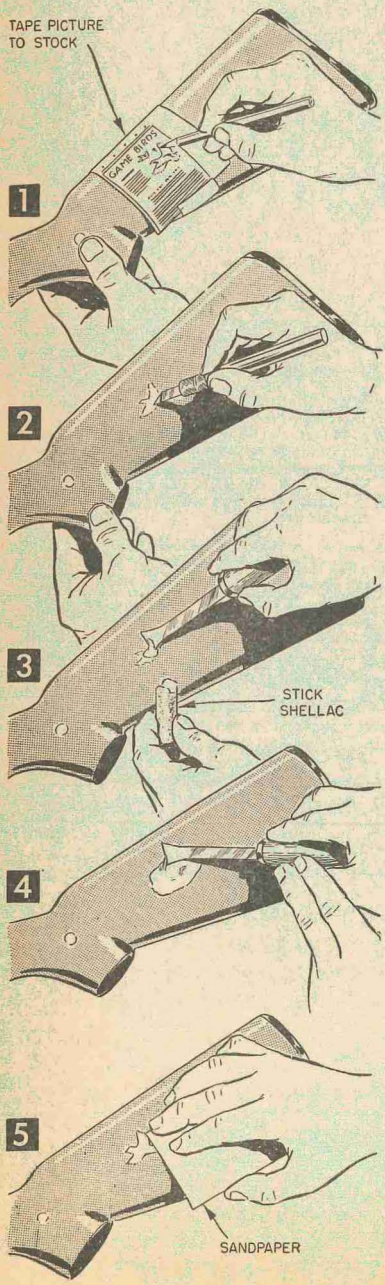
After completion of machining operations, melt the Cerro-Matrix out of the chase and salvage for re-use on similar jobs.—H. J. GERBER



Inlaying a Gun Stock

BEAUTIFUL simulated-inlay designs on stock (as shown in photo above) or forearm of your favorite gun can be yours for little effort and cost. Taking a tip from furniture factory patchers who use the same method to repair flaws in furniture, you will need a small piece of stick shellac, which is available at most retail furniture stores or from Golden Star Polish Mfg. Co., Inc., Dept. SM, 400 E. 10th, N. Kansas City, Mo. Artistic ability is not necessary because just about any type or size design can be found in the advertisements of sports magazines. Follow the steps illustrated here and you will have an individualized gun to be proud of.

—LYNN BRUEBACK.



STEP 1

Start by cleaning all oil off the gun stock. Then cut out desired design, and, leaving at least 1/2-in. border all around, put carbon paper and design on stock and tape in place. Trace around edge of picture with a hard lead pencil or a sharp scribe. Untape one edge to see that transfer has been made properly before completely removing design.

STEP 2

With a sharp jackknife or X-acto blade cut out design on stock to a depth of at least 1/32 in.; if less the dark wood may show through shellac inlay. Always make shallow cuts and use little pressure to prevent damaging knife slips. First outline the pattern with the knife; then begin removing the center by slanting blade toward edge of design. The bottom does not have to be level as long as all high spots are removed. Indicate wing tips, feather, hairs or grass by a single cut of the knife into which the hot shellac will flow.

STEP 3

Heat a heavy-bodied kitchen knife over gas flame just enough to melt stick shellac, not burn it. Fill cut-out area with shellac until level, spreading with a sliding motion. Do not hold knife in one spot. Reheat knife as necessary to complete the job, always wiping it off before and after so that there will be no burned shellac particles to discolor the inlay.

STEP 4

Build the shellac filler higher than needed; then, to remove the excess easily, dab a little 20 wt. motor oil around the inlay. Work shellac smooth and, with a hot knife, roll excess shellac on the oil. As shellac will not stick on the oil, it can then be removed with a thin, cold knife.

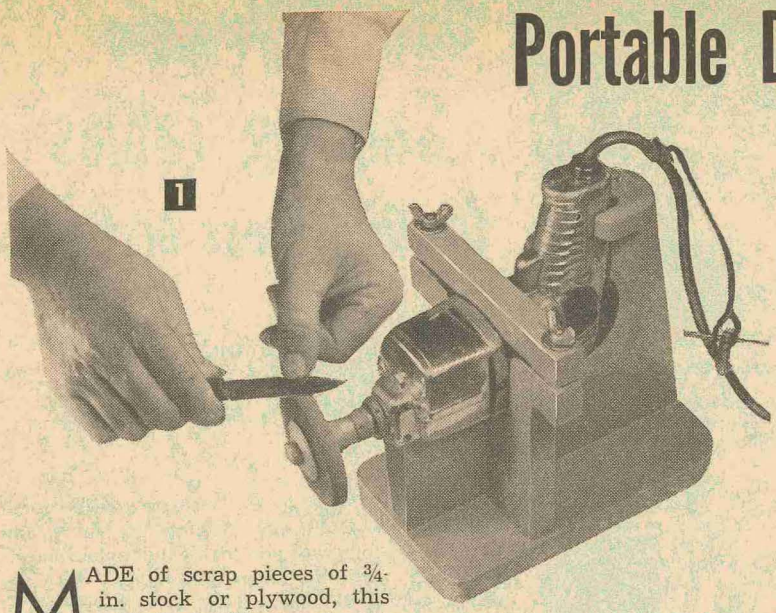
STEP 5

Now saturate #420 wet or dry sandpaper with oil and sand the fill level with the surrounding surface. Keep plenty of oil on the work to retard the cutting of the wood but speed up the removing of the shellac. Check your progress often and keep the sanding local to remove evenly. When inlay design is level, all edge lines will be sharp and clear. Smooth out any pinholes with a warm knife.

STEP 6 (not illustrated)

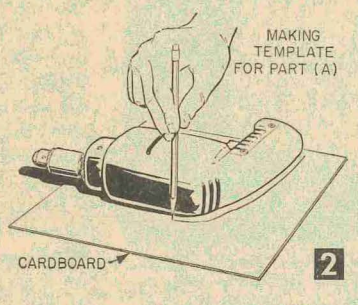
The easiest way to finish the job is by French polishing. Mix two parts of shellac to one part alcohol in a small bottle. Bunch a clean cloth into a small ball and apply some finish material to it (do not saturate); then add a little oil to keep pad from sticking on the work. Using a stroking motion, run pad back and forth across work, keeping it moving when touching work and when lifting it off. Do not stop motion at any time with pad in contact with work. When not using the pad, lay it on an old piece of wood; it will soften the finish of any furniture on which it may be placed. Finish dries almost immediately, building up a very durable and beautiful finish in three or four minutes. If too glossy, dull with fine steel wool.

Portable Drill Stand



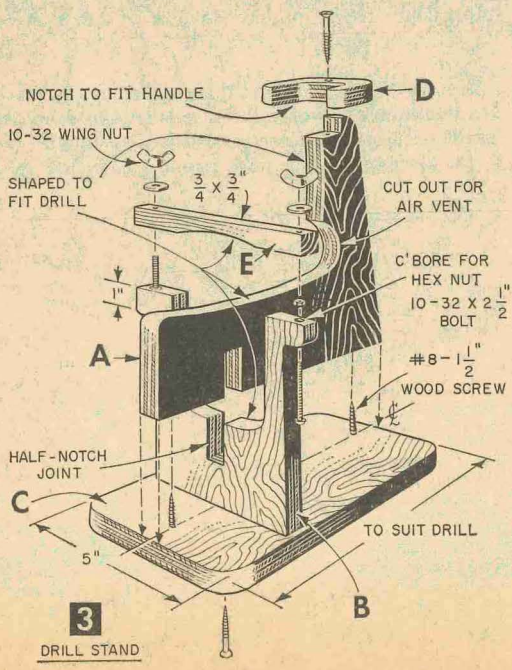
MADE of scrap pieces of ¾-in. stock or plywood, this drill stand will convert your portable electric drill into a stationary, bench-mounted power tool (Fig. 1) for grinding tools and knives, wire brush cleaning of small metal parts or drum and disc sanding of hand-held pieces.

Since the various makes and models of drills vary in size and shape, determine the dimensions of the stand parts directly from your drill. Starting with part A (Fig. 2), lay out a cardboard pattern by drawing around the drill, providing a cut-out at the air vent and making the general outline as in Fig. 2. Cut out the pattern, transfer the outline to ¾-in. stock, then jigsaw to shape. Chuck in a drill bit or long straight piece of rod, and with drill fitted into part A, check it with a level; if necessary, plane off the bottom of part A until the drill spindle is level. Proceed in like manner with the U-shaped part B, drilling and counterboring for # 10-32 bolts and nuts. Leave threaded part of each cap screw extending upward as a stud for the wing nut.



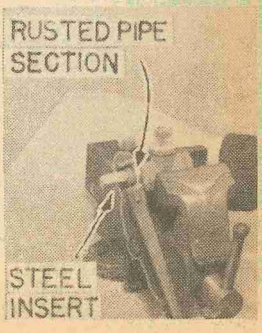
Notch and fit parts A and B together, and mount on a plain rectangular base with rounded corners (part C). Next, make part D of ½-in. plywood with a notch slightly larger than the drill handle width. Notch the top of part A for part D and screw the latter in place to secure the drill handle in a vertical position. Make a pattern for part E, transfer to stock and cut out. Drill two holes to align with those in part B in which the #10-32 bolts are mounted. Washers and wing nuts secure this part in place and permit easy drill removal. Finish the stand as desired.

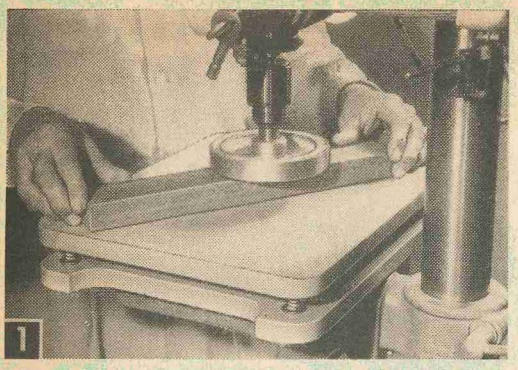
In use, fasten the stand to the bench top with a clamp or screws, or grip in a wood vise.—J. V.



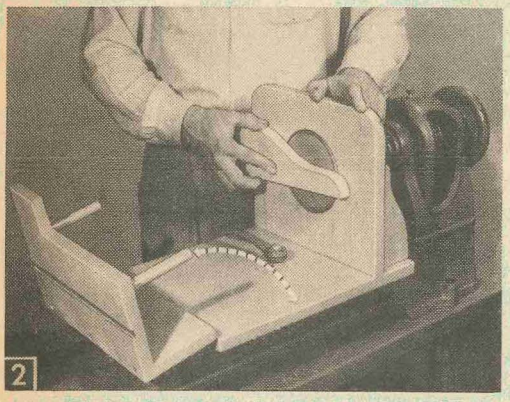
Removing Rusty Pipe Sections

• When removing rusted pipe nipples, insert a piece of round steel snugly inside nipple to protect it against wrench pressure which may cause pipe to collapse, making removal difficult, spoiling a fitting or making re-tapping necessary.—S. C.





Press down on your "cushion" table, and slide the work piece under the sander. Then release the pressure, allowing the springs to press the stock upward, for accurate, even sanding. Adjust your drill press quill to regulate the pressure.



The vertical table eliminates uneven sanding marks and gouging of the work piece. Horizontal table is shown hinged out of the way to increase working space.

"Old Pro"-Designed Sanding Tables for Drill Press or Lathe

Adding "cushioning" action and all-around support prevents binding and scorching

PRESSING gently downward will free the work piece, when you are sanding with the resilient auxiliary table on your drill press (Fig. 1). Or providing an all-around support for lathe sanding jobs (Fig. 2), gives you safer control of the work.

Both auxiliary tables help prevent stalling of the machine or burning the wood in one spot.

You will also find that you get more service from each sanding disc, because with either table, every part of the abrasive surface is made usable.

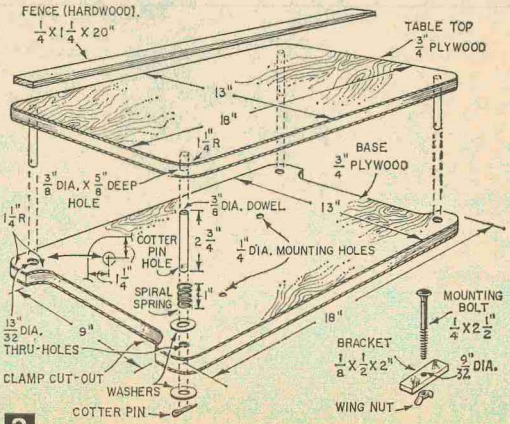
The Drill Press Table dimensions depend on the size of work you plan to handle. Figure 3 details an 18-in. table which would be ample for sanding table legs, cabinet parts and fittings not longer than about 2 feet. If, however, you plan to sand a lot of longer work, then increase the length proportionately. Make any fence you use about 2 in. longer than the table to guide the work, and for ease in clamping. Note cutout portion of table (Fig. 1) for use in clamping down a fence. For greater accuracy, you can use a straight metal bar or angle for the fence.

The dowel holes in the base and table must be lined up accurately. Clamp the table and base parts together and drill the holes simultaneously, with the base up on top. Use the depth stop on the drill press, since the holes in the table part have a depth of only 5/8 in. Then enlarge the through holes in the base with a drill or round file to $13/32$ in. Place the base on your drill press and drill the mounting holes to match diagonally opposite slots in the table casting. Note that the mounting brackets are made slightly narrower than the drill press table slots, so the device can be quickly removed.

Fasten the dowels with glue and coat their tops with paraffin or paste wax to prevent binding. Coat the table surface lightly with linseed oil, for easy action. Paint the rest of the assembly to match your drill press. Since the washers must slide freely on the dowels, you will need to ream or drill the standard 3/8 washers up to $13/32$ in.

You can use any one of the many types of sanders available, provided the disc is true and solidly chucked and the paper is securely fastened.

In sanding on the drill press, *remember that*



3 DRILL PRESS SANDING TABLE (DESIGNED FOR ROTARY SANDERS)

MATERIALS LIST
Drill Press Sanding Table
All dimensions in inches

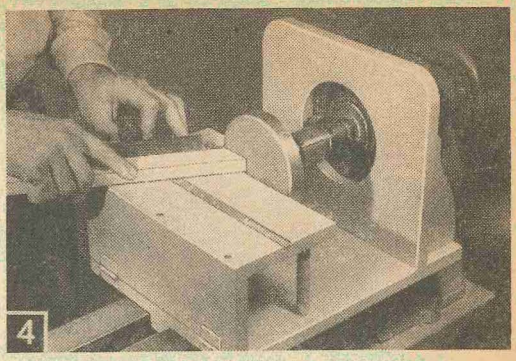
No. Pcs.	Description	Size
1	base	¾ x 13 x 18
1	table	¾ x 13* x 18*
1	hardwood fence	¼ x 1¼ x 20*
4	maple or birch dowels	⅜ dia. x 2¾
4	spiral compression springs medium tension	1" long x 1 3/32" I.D.
8	metal washers with 1 3/32 dia. hole	⅞ dia.
4	cotter pins	¾ long
2	carriage bolts and wing nuts	¼ x 2½
2	metal brackets	⅛ x ½ x 2
1	small container, liquid glue	

Wood Lathe Sanding Table

No. Pcs.	Description	Size
1	base (trim to length after assembly)	¾ x 12 x 15½*
1	vertical table	¾ x 12 x 10
1	horizontal table	¾ x 8 x 12
2	hardwood braces	¾ x 3 x 7
1	hinged piece	¾ x 4⅛* x 12
2	maple or birch dowels	⅝ dia. x 4⅝*
2	hardwood guide blocks	¾ x 1½* x 1½
1 pr	butt hinges	1½ x 1½ (open)
12	*fh* screws	#9 x 1¾
1	small container, liquid glue	

Unless otherwise specified, all parts are cut from ¾" Douglas Fir plywood.

Dimensions accompanied by an asterisk (*) are optional.



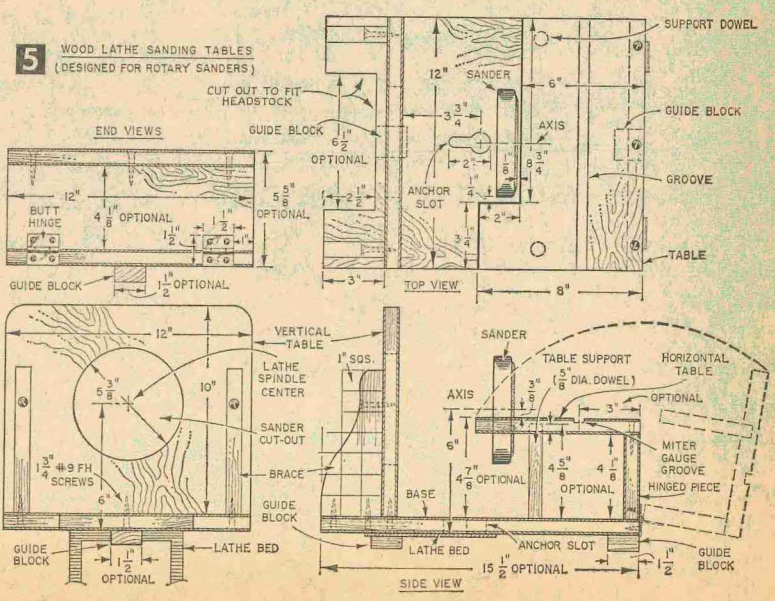
Always edge-sand on the near side of the abrasive disc. If your chuck has a tapered shank, for safety, be sure it is anchored firmly in the lathe spindle.

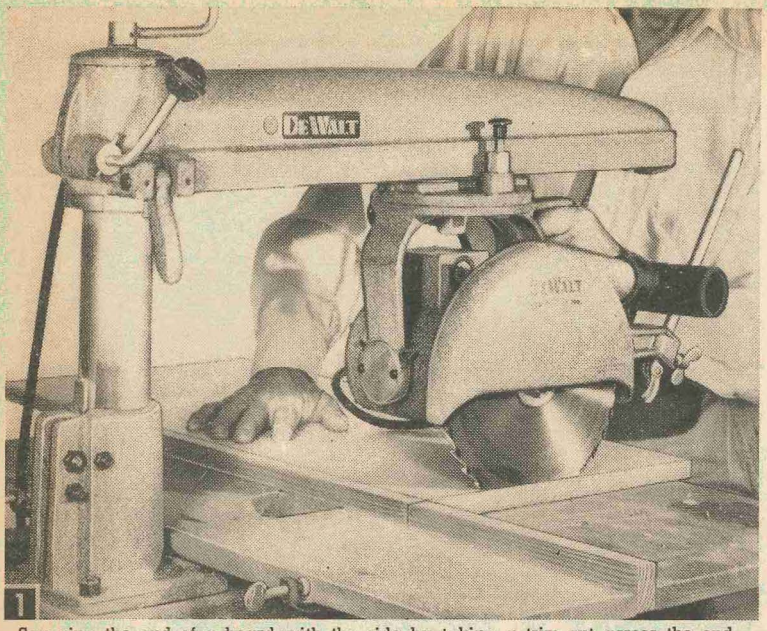
the speed should do the work, not the pressure. Generally the highest speed on your machine will be best for fine work, although sometimes when cutting with heavy abrasive paper, especially on soft stock, the action will be better at low speed because less heat and gumming of the paper occurs.

The Lathe Sanding Table has two uses (Figs. 2 and 4), and is shown mounted on a 6-in. (12-in. swing) lathe. If the spindle of your lathe is not 6 in. above the bed, alter the dimensions of the hinged part and the dowels, so that the working surface of the table is ⅜ in. below the spindle axis (Fig. 5). The hole for the sander is cut to clear the sanding disc that you use.

Cut the base from a piece of ¾-in. plywood, and make it about 18 in. long— it will be trimmed later. Depending upon the make of your lathe, you may need to alter the 15½-in. dimension to suit the overhang of the sander from the headstock. Saw the cut-out shown in Fig. 5, to accommodate the headstock of your lathe, and cut the anchor slot in the base to fit the lathe clamp plate (Fig. 2) which ordinarily holds your lathe tool support. Make the table from the same ¾-in. plywood stock and saw an accurate slot to fit the miter gage from your table saw, or bandsaw. Attach the vertical table and braces to the base with screws and glue. The guide blocks must fit the ways of the lathe accurately, and be mounted so the table will be exactly at right angle to the axis of the spindle. Locate the center for the circular hole in the vertical table by using a nail held in the lathe chuck. Then cut out the hole to fit your sanding disc.

After completing the base and vertical table assembly, bolt it on the lathe with its cutout portion around the headstock (Fig. 4). Place the horizontal table on the base, and mark its outside edge on the end, as a guide to saw off the surplus material. Attach the table unit with butt hinges. Coat all working surfaces with linseed oil to reduce friction, and paint the rest so that it will match the prevailing color scheme of your lathe.—FRANK HEGEMEYER.





1

Squaring the end of a board with the side by taking a trim cut across the end. Since the saw instead of the work piece is moved, long unwieldy boards can be handled with ease and quickly cut to size.

Radial-Arm Saw Savvy

How to make crosscut, rip, miter and bevel cuts; use a dado head for rabbeting; make lap and finger joints, mortise and tenon joints; and groove for splines. Table for determining angle of compound miters. Making and using a taper-cutting jig

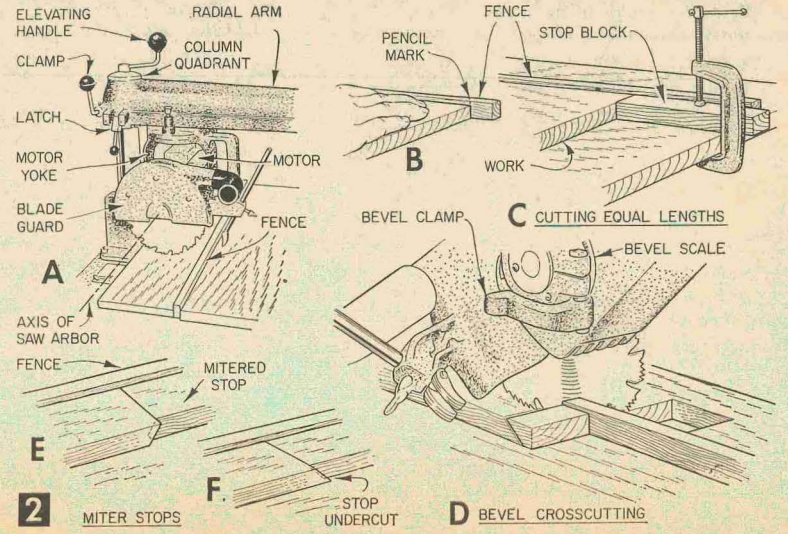
By EDWIN M. LOVE

FOR several years now lumber yards and housing development contractors have used radial-arm saws instead of bench or table-type circular saws to saw lumber to required sizes because it can be done faster on the radial saw and therefore reduces the number of man hours spent on a job.

The same speed and ease of handling large unwieldy pieces of lumber applies when the smaller, scaled-down version of the industrial radial-arm saw (Fig. 1) is used in the home workshop. Any type of saw blade suitable for use with a table saw can be used on a radial saw, and the setup and changeover for straight to bevel cutting or crosscut to rip sawing can be made in minutes.

Crosscutting. Lock the motor and yoke so that the saw arbor is horizontal and parallel with the fence on the saw table (Fig. 2A). Check the radial arm to make certain its indicator is on the zero mark on the column quadrant scale. Then lock the arm latch and clamp. Adjust the elevating handle so the saw teeth just graze the table top.

To trim and square the end of a board, first brush away sawdust that might prevent even contact with the fence, and lay the board on the table with the end to be cut at the left. Then slide it endwise to align the cutting mark with the blade teeth set to the right. If the board is long, support the projecting end on a bench or other prop, or clamp it to the table. Turn on the saw and pull the saw carriage across the board with your left hand



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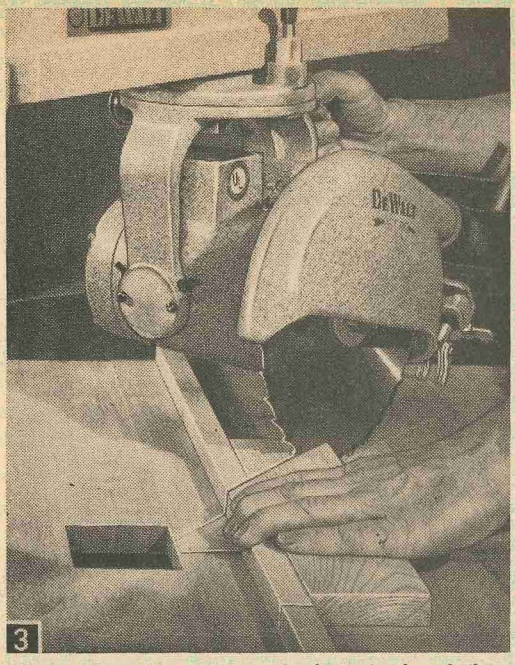


To make a miter cut across the face of a board, the radial arm is swung to the right or left and locked in place at the desired angle.

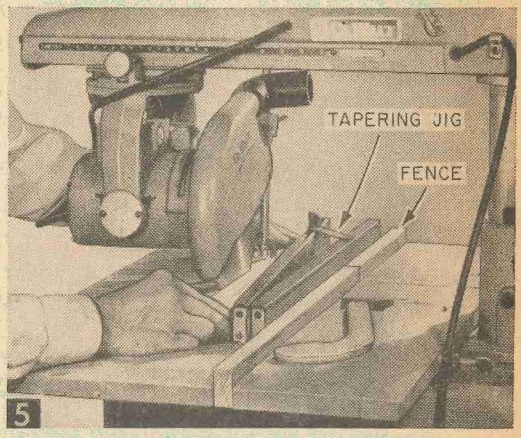
while your right hand holds the board against the fence and table (Fig. 1). Actually, either your right or left hand may be used to pull the saw carriage while your other hand holds the work. Since the carriage travel or feed is away from the tooth movement, little pull is needed.

When cutting each end of a board to length, keep the same edge against the fence for both cuts so that each end will be cut square to one edge and parallel to one another. With a little practice the length mark can be aligned with the side of the blade as it runs, locating the kerf in the waste. If the cut is to be smoothed, make a little allowance by cutting the board about 1/32 in. long. This is unnecessary if a planer blade is used.

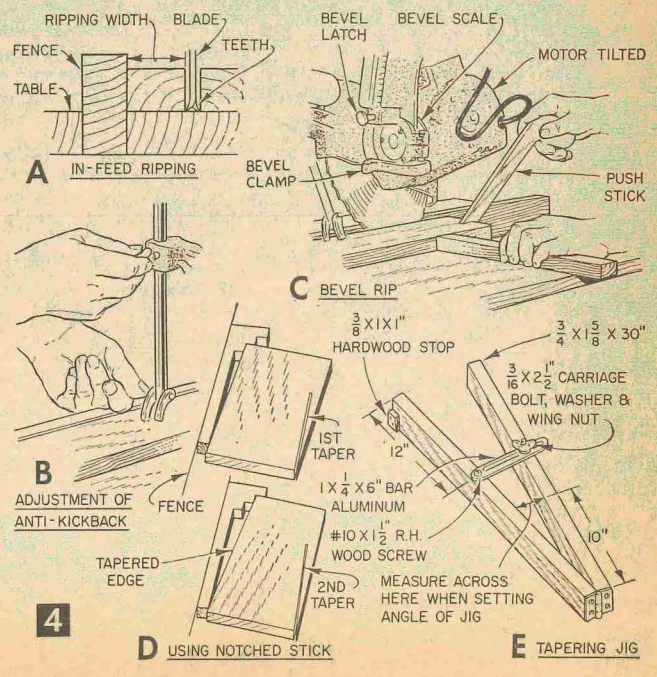
Boards thin enough to clear the underside of the motor can be cut in one pass; thicker ones require two cuts, the first a little more than halfway through, the second after the board is turned over with the first cut aligned with the blade. Unless it is certain that the edges are parallel, turn the piece end-for-end to bring the same edge to the fence.

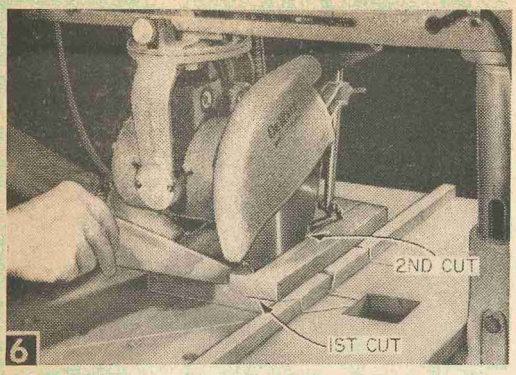
For cutting several pieces to the same length, make a pencil mark on the fence as in Fig. 2B, and bring the squared end to it each time a pass is made with the saw. Make allowance for the width of the saw kerf and end smoothing. Instead of a pencil mark, a block may be clamped to the table (Fig. 2C) to butt the end of the board against, making positioning automatic. While this can be placed at either end of the table, or on an extension, it is usually handier if clamped at the right so that the saw can be pulled with your right hand and the work slide along the fence with your left hand.

Mitering and beveling. To miter or crosscut a board at an angle as in Fig. 3, swing the radial arm to the right or left, depending on the direction of cut, and lock in place. If the cut is other than a miter of 45°, and great accuracy is required, make test cuts in waste stock and readjust if necessary. When cutting to length, as in squaring, allow for width of saw kerf and smoothing.



Making accurate tapered cuts is simplified when this adjustable tapering jig is used to guide the stock and hold it parallel with the saw fence.





After making the first cut of the rabbet with the blade in the horizontal position, the saw is set in the normal ripping position as shown to make the second cut of the rabbet.

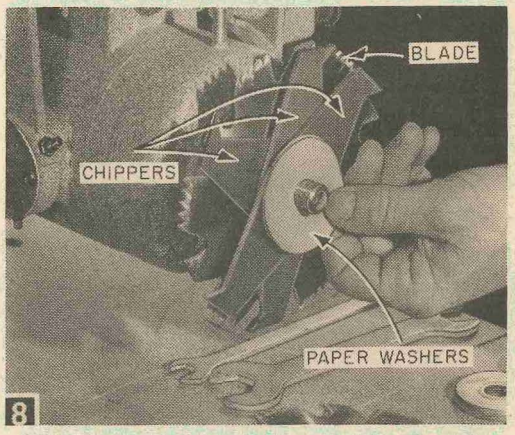
Bevel cuts through the thickness of the stock, are made as in square crosscutting except that the motor is tilted to the angle (Fig. 2D). At 45° the bevel latch (Fig. 4C) seats in a socket and sets the angle automatically. For bevel cuts other than 45°, tilt the motor to the required angle according to the bevel scale and lock with bevel clamp. If the work extends to the right, the angle is undercut; if to the left, it slopes back from the table.

When using square stop blocks for gaging length, hold the knife edge of the miter lightly against the stop, as the thin wood is easily crushed. A mitered stop clamped with the long side on the table (Fig. 2E) prevents crushing, but take care that the piece rests firmly on the table. If the stop is turned over (Fig. 2F), the miter fits under the stop overhang. Be sure no sawdust lodges there, holding the work away from the stop.

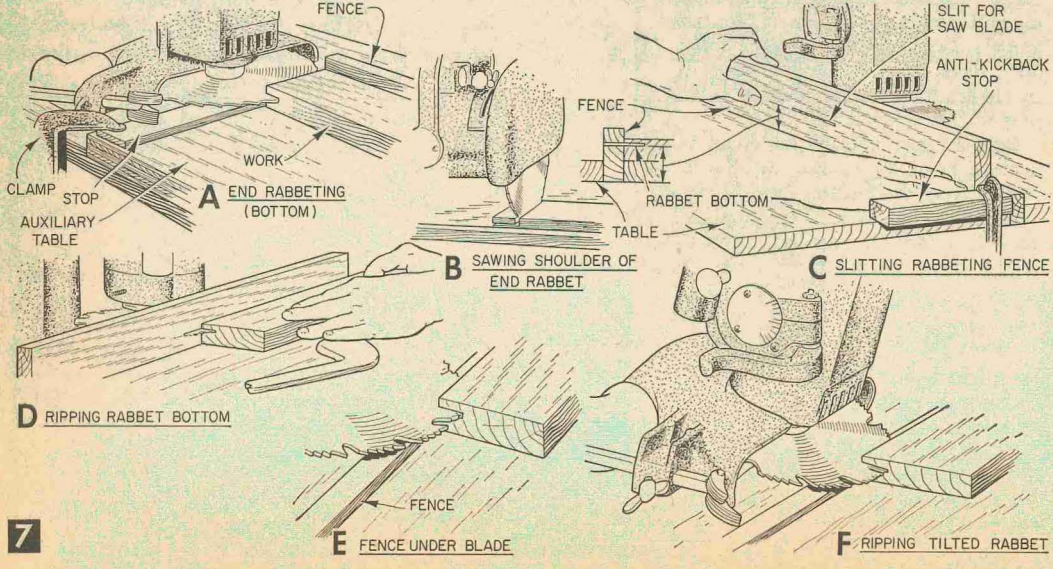
Ripping. Turn the motor at right angles to crosscutting position. For narrow strips set the blade toward the fence as in Fig. 5 by raising the arm to clear the teeth and pulling the motor far enough forward to give room for swiveling it. Move the carriage along the arm and lock it where the tooth set of the blade is as far from the fence as the width of the piece to be ripped, plus allowance for jointing (Fig. 4A). Lower the motor to make tooth contact with the table. This is the "in-rip" position.

Adjust the guard by rocking the forward end down close to the board, and lower the anti-kickback claws (Fig. 4B) until they incline in the direction of feed, which is against blade rotation. If the saw should bind these claws seize the board and prevent it from being thrown out from under the saw blade. Rip by sliding the board on the table against the fence, using push sticks on small work to protect your fingers (Fig. 4C).

When a wide board is being ripped, turn the motor so the blade end is toward the outer edge



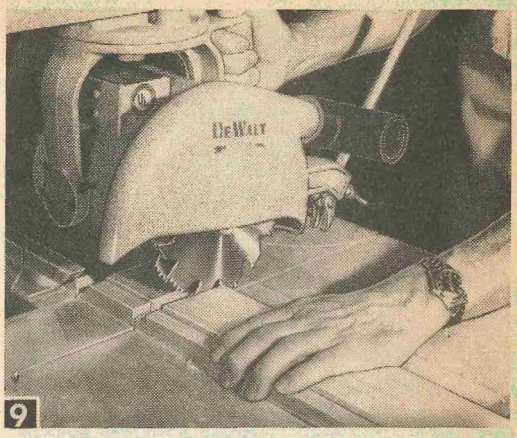
The width of the cut made by a dado head can be adjusted to fine limits by inserting paper washers between the cutters.



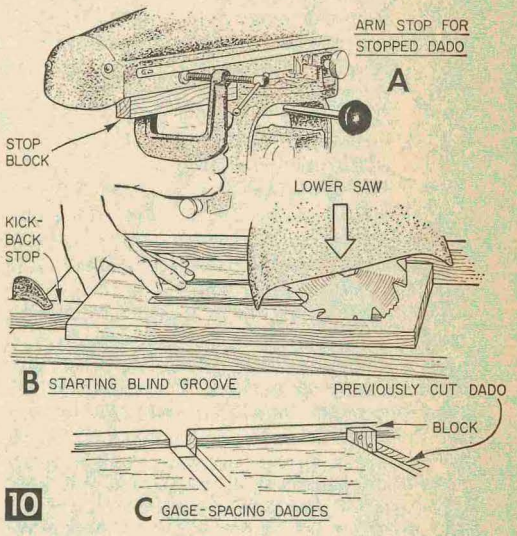
of the table, in the "out-rip" position. Feed the work into the saw from left to right. To bevel rip, raise the saw, tilt the motor as for beveling across the grain, lower until the teeth graze the table, and rip as before.

Taper ripping. Provision must be made to feed the board at the desired angle. One method is to clamp a straightedge to the under side of the work, inclining it at the angle of cut. This, sliding against the outer edge of the table, steers the board on the right course. For shorter stock a notched stick to hold one end of the board out of parallel with the fence is used as in Fig. 4D. If both edges are to be ripped, provide a double notch, using the shallower for the first cut, the other for the second. An adjustable tapering jig (Fig. 4E), having two legs hinged at one end, is a useful shop accessory that can be set for any taper, the amount of spread being measured 10 in. from the pivot. This represents "rise and run" measurements, which can be read from Table A if the angle of slope in degrees is given in plans. In use, hold work against stop on one leg of jig and slide other leg along saw table fence as in Fig. 5.

Rabbeting by sawing is one of the cleanest methods of forming the edges of lip doors and drawers, as well as for recessing the back edges



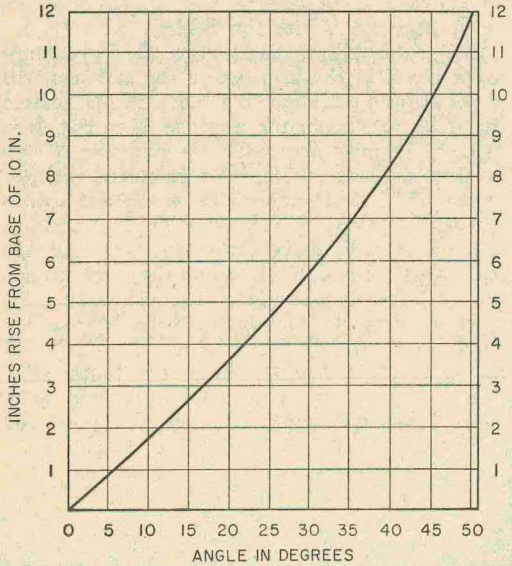
The depth of a dado cut is controlled by raising the radial arm so that the saw tips clear the table a measured amount.



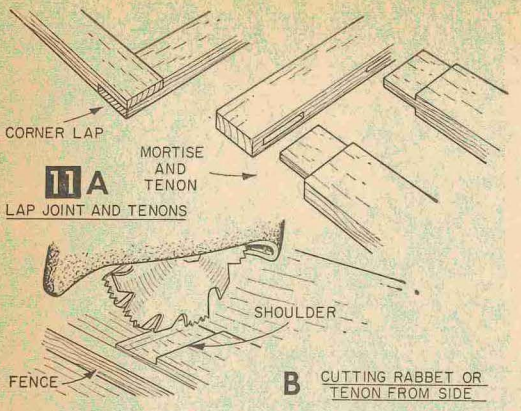
of cabinet ends and tops to receive the backs. For this operation turn the motor to the vertical position (Fig. 7A). When end rabbeting, the guard is at the left; for ripping, at the back. Since the saw guard will not allow the blade to be lowered close enough to the table top, lay a sheet of plywood on the table to elevate the work. The fence must be high enough to rise above this auxiliary plywood table. The depth of the rabbet, it must be remembered, is determined by the underside of the blade, and the downward set of the teeth. Locate the end of the piece with a pencil mark on the fence or a stop made from a thin strip of wood clamped or tacked to the table as in Fig. 7A.

When the bottom of the rabbet is cut, remove waste material by making several cuts or passes, raising the motor one turn of the column screw to a pass, or swing the motor to the horizontal position and cut the shoulder as in crosscutting (Fig. 7B). For ripping, the guard can be removed and the blade projected through a self-cut slit

TABLE A



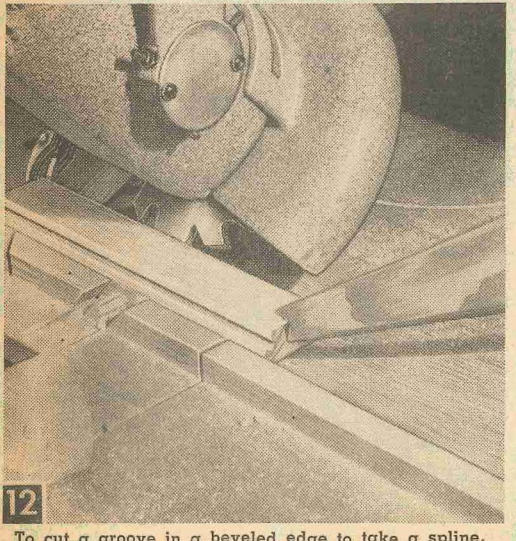
When the amount of taper is given in degrees, it is convenient to change it to terms of "rise and run," which can then be read from this table as so many inches rise of the angle in a base length of 10 in. For instance, if the desired angle is 30°, follow the vertical line above 30° to the curve and read along the horizontal line, noted as 5¾ in. at the left and right margins. If the intersection falls between horizontal lines, estimate the fraction of an inch. Measure 10 in. along one leg of the tapering jig from the center of the hinge pin, and 5¾ in. square cut, inside to inside measurement, to locate the other leg.



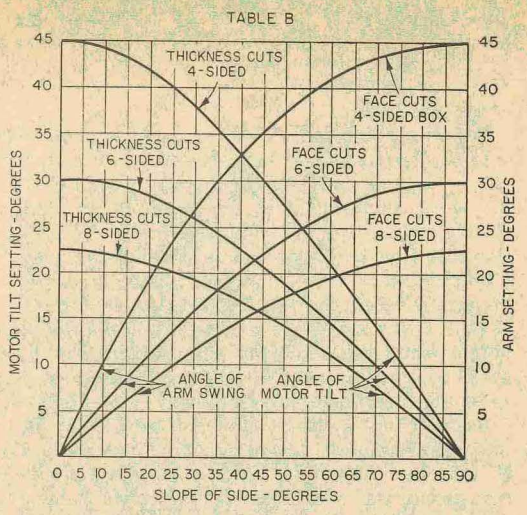
in the fence (Fig. 7C), which provides continuous guiding surface for the edge of the board (Fig. 7D); or the fence can be low enough to pass the blade above it (Fig. 7E). Cut the waste in a normal ripping operation (Fig. 6), shifting the push stick to the strip being severed near the end of the cut to keep it from being thrown.

The rabbet can be tilted by tilting the motor as in Fig. 7F, the shoulder being square with the bottom, or square with the face of the work, according to the motor setting.

Dadoing and grooving have numerous applications in cabinet work. In all cases the setup is the same as for sawing, except that the teeth of the blades are above the table. Most dado heads are adjustable up to $13/16$ in. in width, small fractional widths for fitting being obtained by inserting paper washers in the assembly as in Fig. 8. When crosscutting dadoes, either square with the edge or at a slant, locate the cut by bringing the pencil mark on the edge of the side of the dado cut into the fence, as in Fig. 9,



To cut a groove in a beveled edge to take a spline, tilt the motor so the dado head is at right angles to the beveled edge. Use two push sticks to guide small pieces of stock so your hands will be in the clear.



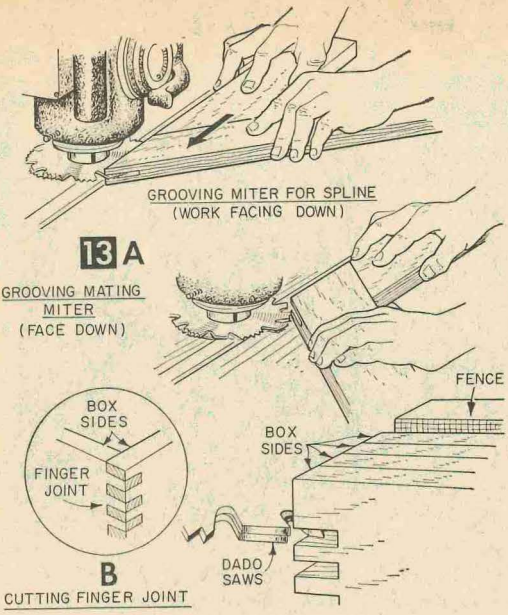
Settings for motortilt are read from curves rising to the left, and for arm swing from curves rising to the right, for hopper cuts of boxes with sides sloping outward. For example, if a four-sided box having sides sloping 20° is wanted, read degrees of slope at the bottom, follow the vertical line to the upper curve to the left, where the intersection indicates 43.4°, the tilt of the motor for the thickness angle. Reading from the upper curve to the right, a setting of 19.5° is given for the arm, the cut across the face of the board. Angle settings for a six-sided or eight-sided box may be found from their curves in the same way.

or by aligning it with the blade.

Stopped rabbets or dadoes are made by clamping a block to the arm where the carriage will strike it, or by placing the block inside against the track to contact the carriage as in Fig. 10A. Stopped grooves are made by clamping a stop block to the fence, table, or an extension clamped to the table, which the end of the board strikes when the groove is long enough. If a dado is stopped at both ends, clamp the saw carriage and lower the running saw into the work, counting the turns and fractions after contacting the work to regulate the depth. Then release the carriage clamp and draw the saw forward until the carriage strikes the arm stop block (Fig. 10A). In grooving, use a kick-back stop (Fig. 10B). Lower the saw into the cut, and then feed forward to another stop block at the other end of the table. Make repeat dadoes of even spacing by fastening a pin or a block on the fence to engage dado ends as they are cut (Fig. 10C).

While dadoing and grooving is easily done on the upper side of a board, where the operation is in full view, the groove will be of uniform depth only if the board is of uniform thickness, and flat. If the board tapers in thickness or length, and depth is critical, block up the thin edge or end.

Lap joints and tenons. These joints, pictured in Fig. 11A, are simply an extension of the rabbeting operation shown in Figs. 7A and B. Rabbets and tenons can also be cut with the motor in the cross-cutting position (Fig. 11B). The



shoulders come out clean-cut, but the cheeks of the tenons and bottoms of the rabbets are slightly uneven because of minute diameter differences in the dado cutters. This method has one advantage, however, and that is that you can cut rabbets or tenons of any length. Make the shoulder cut first, then remove waste with overlapping cuts progressing toward the end of the work piece. Sawing tenons from both face sides of the work centers the tenons perfectly if the board is straight, or clamped down straight. Tenon thickness, however, will vary with board thickness unless adjustments are made in the setting.

Grooving for splines. Grooves cut in mitered ends for inserted splines are made by setting the motor vertical (Fig. 13A) and using a dado head, usually ¼ in. in thickness. By tilting the motor to cut at right angles with the face of a miter or beveled edge (Fig. 12) the work can be grooved for a spline.

Compound miters. Miters cut diagonally across the face of a board, or along a taper are called hopper joints, and are useful for mitering wide picture frames, making boxes with sloping sides, and cutting jack rafters for roof framing. In method of cutting, they differ from ordinary sawing only in tilting the motor to give a beveled effect, but the setting involves complications in determining the desired angle. On a square box having vertical sides the corners are mitered at 45°. But, if the sides slope outward at the top the angle of the mitered corners is greater than 45° depending upon the angle of slope. A six or eight-sided box also has miters that vary from the base angle. The angles at which to set the saw for hopper cuts are given in Table B. Ripped miters can be dressed smooth with a shaper head having square edges.

Finger joints. These joints provide a large gluing area which makes the joint very strong. Clamp the four sides of the box together with ends and edges in alignment as in Fig. 13B, and cut a series of slots with a ⅛-in. saw blade, such as a dado, saw, to the depth of the wood thickness, or a little more to allow for dressing flush after assembly. Use two blades for ¼-in. fingers. Cuts are spaced with two or four turns of the column screw, which lifts the blade ¼ in. or ½ in. Align the mortises of the other ends with the tenons on the first ends so that the corners will go together with the edges even.

Mortising. Mortises for stub tenons can be made by sliding the edge of the piece against the horizontal dado head, using an anti-kickback stop to keep it from being thrown, a good production dodge if the stile is grooved for a panel. Make blind spline mortises in a mitered end by pushing the end into the saw along a mitered piece clamped on for a guide.

Washer Polishes Rotating Shaft

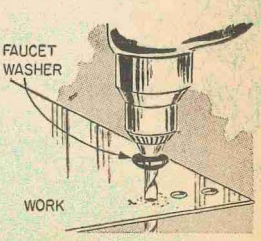
• When setting up any kind of machinery involving horizontal shafting, always slip a large leather washer onto each such section of rotating shaft between any two bearings. The spinning shaft will spin the leather washer, and the washer in turn will "shuttle" back and forth along the length of the shaft between bearings, keeping it rust-free and shining. The hole in the washer should be much larger than the diameter of the shaft, but need meet no specific dimensions. For shafting already installed, split the washer to install.—ANDREW VENA.

Rest-less Dowel Turning

• To turn dowel rods to be cut into fine moldings, without a center rest, make a metal guard to slip on the chisel, with two prongs bent up to ride on top of the rod. Place one hand, with a bit of sandpaper, over the work. You can turn the entire rod without chattering. Molding plane bits make good cutters. Shape them to make the style molding you want. Rip the completed stick into flat molding quarter round or three-quarter round. Try it. I have made many hundreds of feet of molding this way.—U. S. MOORE.

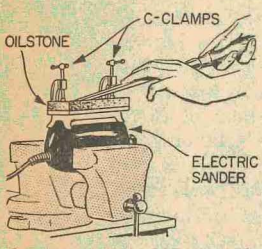
Drill Chuck Cushion

• When drilling a number of holes in polished metal, prevent the drill chuck from slamming against it when the drill breaks through and marring the metal, by slipping a rubber faucet washer over the bit. Slide it up against the chuck. If necessary, enlarge the washer hole for larger bits. —VICTOR H. LAMOY.



SHOP KINKS

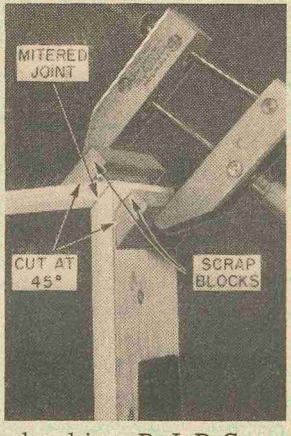
Sander Sharpens Tools



• If you have a smooth-running electric sander with forward and back motion, you can use it as a tool sharpener to put an edge on everything from a pocket knife to a small ax. Use a pair of small C-clamps to attach an oil-stone to the face plate of the sander, then clamp sander in a soft-jawed vise. Speed of cut depends, of course, upon coarseness of stone used. The sander should not have too violent an action or you will have trouble in holding the tool against the stone properly. —G. M. BROOKE.

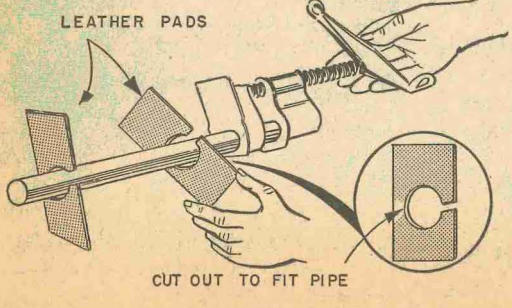
Assembling Mitered Joints

• A mitered joint is difficult to assemble without some means of holding the two pieces of stock. The fastest, easiest way to do this is to cut one edge of two scrap blocks at a 45° angle and tack-nail them to the project on either side of the joint. A clamp will then draw the parts tightly together and hold them firmly until the glue dries.—R. J. DEC.



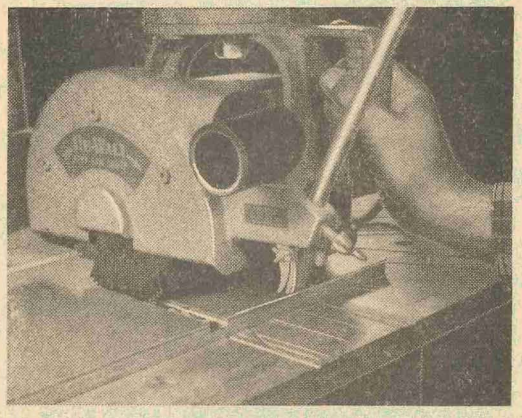
Leather Clamp Pad

• When clamping freshly-glued furniture with a bar or pipe clamp, use two leather pads to protect the wood from becoming marred. Cut the pads from an old boot or other scrap leather in the shape of the metal jaws of the clamp. A hole and slit in one end of each pad will enable you to slide it over the pipe for convenient positioning.



Stop Radial Saw Climbing

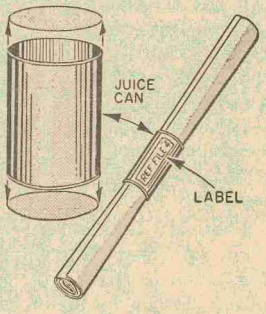
• The tendency of a radial saw to "climb" the stock when making a deep, wide cut is safely and easily overcome in the following manner. Pull



the motor head out to the front end of the arm, put the stock in position and *push* the blades through instead of *pulling* them. Since the blades are removing the stock ahead of them they can't possibly climb. As always, cuts are smoother when you cut slowly—let the teeth cut, don't force.—R. J. DECRISTOFORO.

Cans Hold Rolled Blueprints

• Small fruit-juice cans with bottoms and tops removed make excellent "napkin rings" into which rolled blueprints may be inserted for storage or carrying. Attach identification label to cans for easy reference.—G. E. HENDRICKSON.



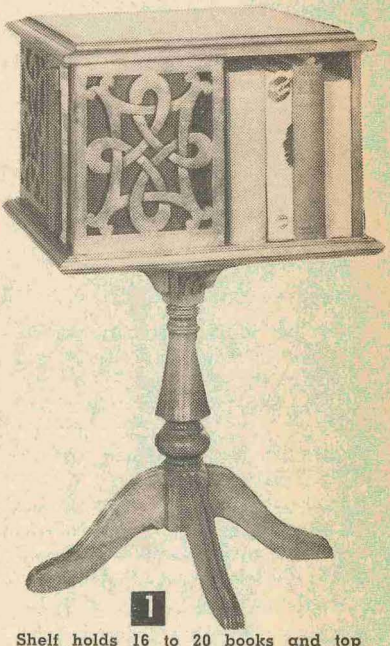
Wax Paper Cleans Tool Tables

• Rub ordinary wax paper briskly over your shop tool-tables. The tables will pick up paraffin from the paper, and thus the protection and lubrication it provides.—R. J. DECRISTOFORO.

Georgian-Style Revolving Book Stand

By EDWIN M. LOVE

Fastening retaining segments to underside of revolving book shelf.



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Shelf holds 16 to 20 books and top which serves as a small chairside table stands 26 in. from floor.

BUILT of mahogany or walnut, this handsome little table will hold your favorite books conveniently at hand on a turntable beside your easy chair. You'll also find this project to be an excellent review of basic power-tool woodworking processes.

To save time during construction we have grouped the work to keep power-tool setup changes to a minimum. Start by cutting the triangular top and shelf pieces (Fig. 2A), by turning the board over for each successive miter cut as in Fig. 3. A sharp planer blade will make the cuts smooth enough so that truing will not be necessary to fit the pairs of blocks together for gluing. Next rip the jigsawed panels and partitions to size (Fig. 2C), running the grain crosswise of the panels to match that of the partitions in order to equalize shrinkage. Rabbet the joining ends of the panels and dado both sides of the continuous partition as in Fig. 2C.

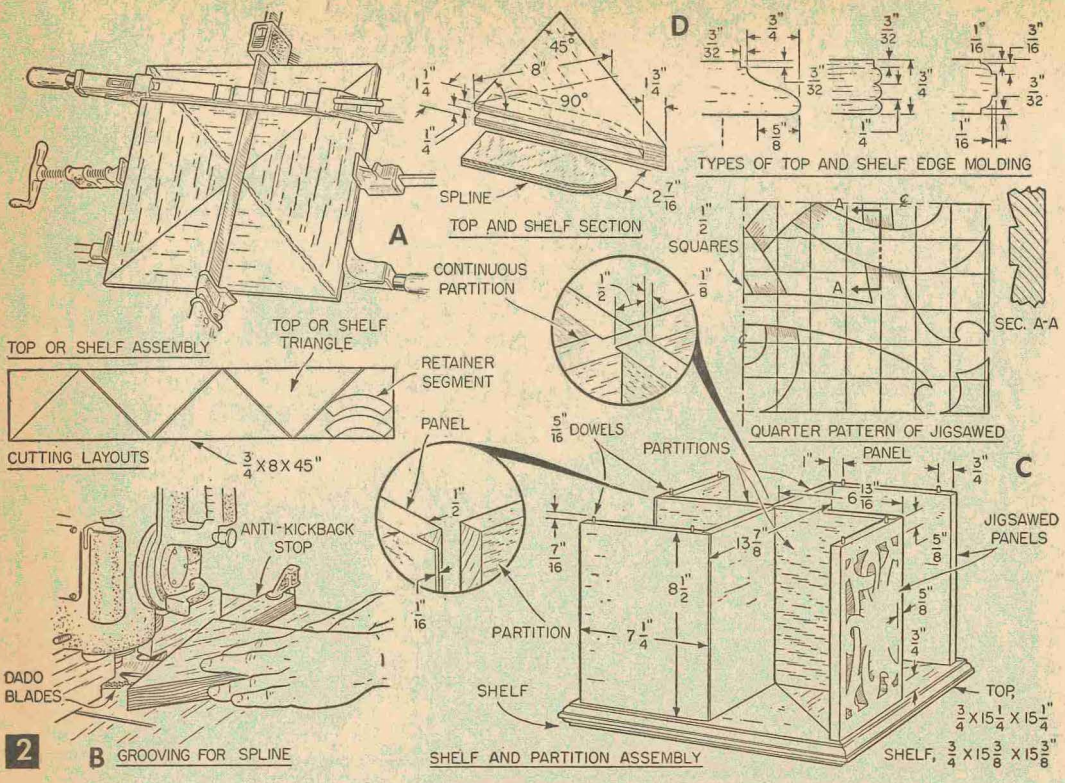
Before removing the blade, prepare the column for turning by squaring it. Rest it on the table against the saw fence, set the blade horizontally, and adjust it for height. The setup is similar to that in Fig. 5. Rip the four sides of one square end. Then turn the piece end for end, reset the blade height, and saw the other end square.

To overcome the tendency of top and shelf boards to shrink across the grain, which would open the joints at the centers of the assemblies,

MATERIALS LIST—REVOLVING BOOK STAND

All dimensions in inches

No.	Size and Description	Use
2 pcs.	3/4 x 8 x 45 African mahogany	top & shelf triangles, retainers
1 pc.	1 x 4 x 21 African mahogany	legs and brackets
1 pc.	3 x 3 x 12 7/8 African mahogany	column
4 pcs.	1/2 x 8 1/2 x 7 1/4 African mahogany	pierced panels
2 pcs.	1/2 x 8 1/2 x 6 13/16 African mahogany	short partitions
1 pc.	1/2 x 8 1/2 x 13 7/8 African mahogany	long partition
1 pc.	3/4 x 8 x 8 fir 5-ply	turntable
8 pcs.	1/4 x 27/16 x 9 fir 3-ply	splines
1 pc.	3/4 x 3 1/2 hardwood dowel	pivot
16 pcs.	5/16 x 7/8 hardwood dowel	partition pins
12 pcs.	1/2 x 1 1/2 hardwood dowel	bracket & leg dowels
4 pcs.	1 1/2-in. flathead wood screws	hold turntable
8 pcs.	1 1/4-in. flathead wood screws	retaining segments



groove the joint edges to receive wide splines (Fig. 2B). These are cut across the grain of ¼-in. plywood, and have the outer ends curved to fit the curved ends of the grooves. Replace the regular fence with a couple of pieces of 1-in. pine notched to lap over the blades beneath the motor end, to guard the blades and narrow the gap. Clamp a kickback block to the table where it will swing the work into the saw with the groove starting 1¾ in. from an outer edge. This distance is important, because if it is less, the spline may be exposed when the edge is molded. Groove the corresponding edges of all pieces, then shift the stop block left so it stops the grooves in the other edges 1¾ in. from the tips.

Mitering triangular sections for top and shelf. Waste end of stock is clamped to table top.

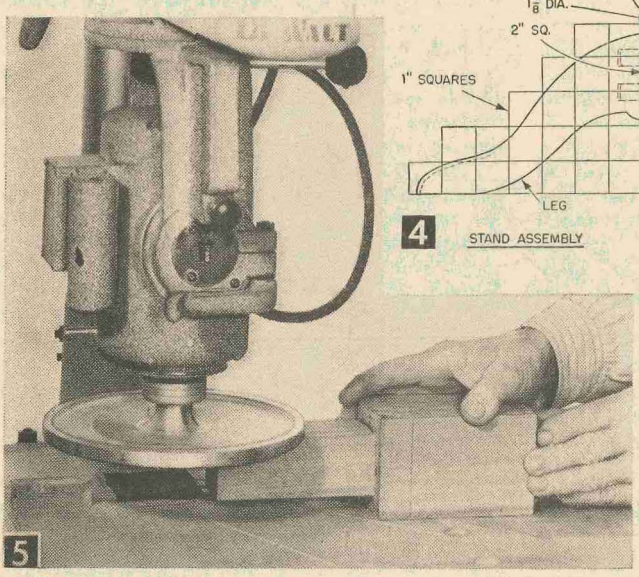
After fitting the triangles in pairs, assemble them dry with clamps to make a final check. Using a slow-drying glue such as *Weldwood,* apply it to the mitered edges to be joined, to seal the pores, let set for a minute or two, and wipe off. Coat one groove and half a spline, and press in the spline. Coat the other groove, the rest of the spline, and the meeting edges, and force the triangles together. Join the other pair the same way, put the dry edges together, and clamp as in Fig. 2A. Align the inner corners of the glued joints, wipe off squeezed-out glue with a damp cloth, and set aside to dry. Then joint the unglued edges, fitting them together with glue. Be sure to align the joints already glued, so that the two diagonals will show as straight lines in the finished piece.

Prepare paper patterns for jigsawed work by sketching them with the aid of squares drawn on paper for the book panels (Fig. 2A), legs and brackets (Fig. 4). Make a complete panel pattern by tracing the quarter section drawing from one side and the other, using center lines to align the quarters. Then transfer the completed pattern to the wooden panel pieces with carbon paper. Bore entry holes in the panel cutouts

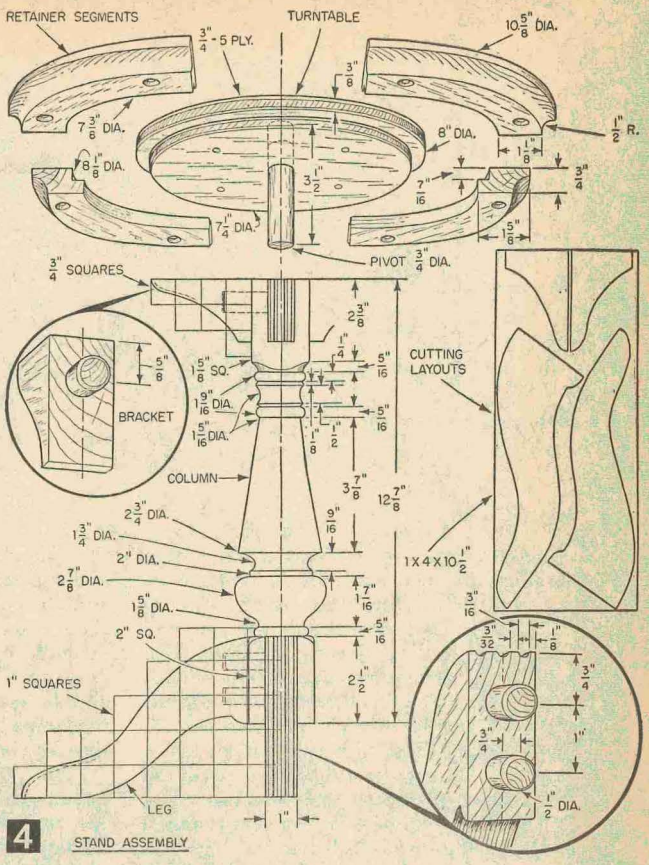
and jigsaw to shape. With a little more labor the panels can be carved to give the straps an interlacing pattern that enhances the appearance. Chisel down the bands as they approach those passing over (Sec A-A Fig. 2C), cutting to a depth of about 1/16 in. at the intersections. Smooth with files and sandpaper, and rub a fine file over the arrises to break them.

Surface the top and shelf and locate the corners by measuring out 10⅞ in. from the center where the joints intersect. Draw boundary lines from these points, saw close to them, and joint straight, being careful to keep the top square, with the corners on the joint lines. Suggestions for edge molding are shown in Fig. 2 D. These are cut with a molding head. The same type can be used both for shelf and top if preferred.

After sawing the legs and brackets to shape, the setup shown in Fig. 6A is useful for shaping the edges of the legs and brackets. If cove cutters are not available they can be ground from grooving knives merely by removing the corners. The guide is made semicircular, matching the curve of the cutters at the edge-line of the work, and is nailed to the auxiliary table. The guard blocks hug the molding head and are placed only far enough back to allow the cutters to work into the hollows. When one outer cove is cut in a leg or bracket, turn the piece over and cut the other. Then adjust the height to center the cutter on the pieces for finishing the molding.



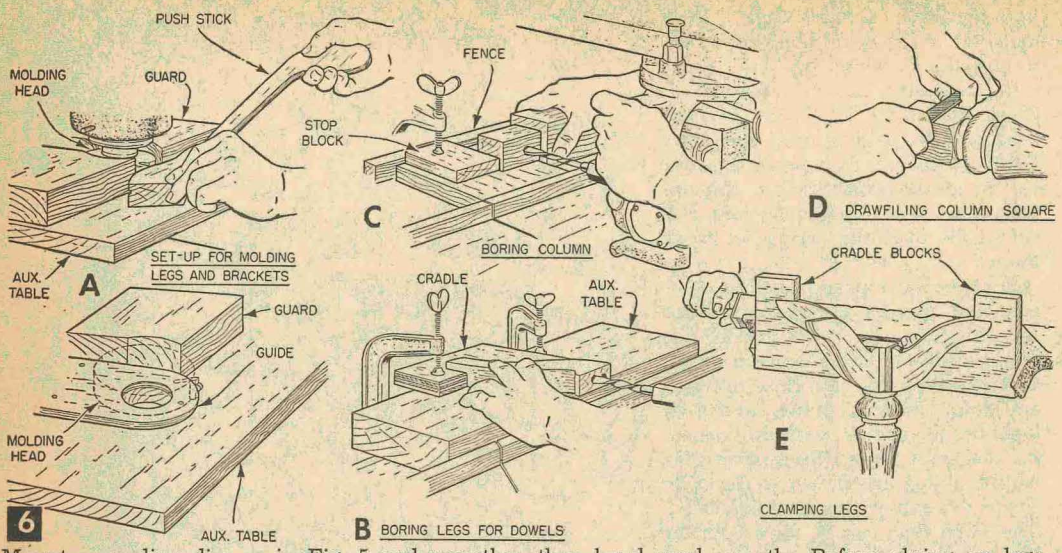
Machine sanding squared ends of column to exact dimensions.



swastika-fashion (Fig. 2C) between the top and shelf, using 5/16-in. dowel pins to secure them. Bore the dowel holes and glue the jigsawed panels to their partitions, applying clamps both ways to force the rabbeted joints together. When dry, break the joint arrises with sandpaper. Assemble the partition pieces dry and check measurements to see that they are the same, then glue together.

To locate the dowel holes in the top, lay it upside down on a padded bench and then position the partition assembly, also upside down, on it, clamping lightly.

Mark the top from center marks brought out from the dowel holes on the faces of the panels. Scribe the lines on the underside of the top, along the panels and partitions, and mark an identifying "X" on one partition and the top so that it will be returned to the same place. Measure in from the lines to locate the dowel centers, making allowance for any offset of the lines. Bore the dowel holes 7/16 in. deep. In the same way locate dowel holes in the shelf. Glue the dowels into the panels and try the assembly together. Make any corrections and then glue the assembly together.



Mount a sanding disc as in Fig. 5 and smooth the squares on the column ends to dimensions given in Fig. 4. Then turn the sanding disc to the vertical position and true up the leg and bracket ends that butt against the column. Also true the turntable and outer edges of the retaining ring segments. Smooth the rest with a sanding drum. The turntable and retainers can be turned by screwing them to backing discs and a lathe faceplate. Be sure to rabbet the retaining ring 1/16 in. larger in radius than the turntable, and give 1/16 in. clearance on the flange faces.

Set up for boring dowel holes in the legs and brackets by jigsawing cradle blocks for them to nest in. Then clamp the blocks to the saw table as in Fig. 6B. Bore one hole in each of a set, then shift for the next hole. Fig. 6C shows the setup for boring the turning squares. Block up the column to a convenient height, set a stop block to locate a hole, and bore one in each face of a square. Then change the stop block and bore the other hole. Only one hole is required for the brackets.

After turning the column to dimensions shown in Fig. 4, draw-file the squares with a mill file (Fig. 6D) to remove sanding-disc scratches and then hand sand smooth. Before gluing on legs and brackets, glue the dowels into the column and dry fit the legs and brackets. The dowels should have enough looseness to permit easy pushing together with your hands. White plastic glue, such as *Presto-Set,* applied both to dowels and holes, is useful here, as the joints can be unclamped in half an hour. Use the boring cradles as clamping bases (Fig. 6E).

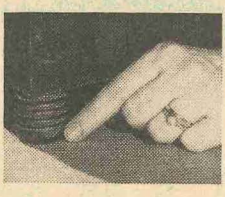
Pivot the bookcase with a 3/4-in. hardwood dowel glued into a 1/2-in. deep hole centered on the underside of the shelf. The dowel passes through the turntable, which is screwed to the stand brackets, and into a center hole in the column. The hole in the column must be large enough to permit free turning. Rub the dowel and the turntable hole with wax. Screw the retainer segments to the shelf underside (Fig. 1).

Sand the book stand thoroughly, finishing with #6-0 garnet paper. Small bruises can be raised by covering the dent with a wet cloth and laying the tip of a soldering iron or flatiron over it until it steams. Remove all visible glue, and go over the piece with a damp cloth to raise the grain, smoothing lightly with #6-0 garnet paper afterward.

Phillips Screw Marking

• Paint an "X" on the end of your Phillips screw driver handle as shown. Then you can keep it in the drilled-block rack over your bench along with your other screw drivers and such-handled tools and find it instantly when you need it, without the usual false grab or two.—F. A. J.

Readymade Cabinet Legs



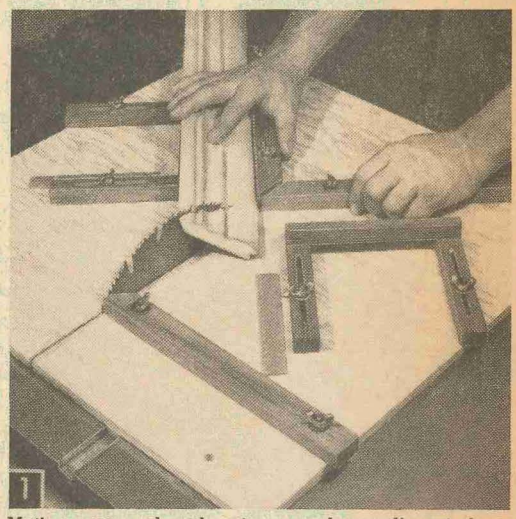
• Small turned legs suitable for cabinets and other small projects are available ready-made, and ready-finished in walnut, mahogany and off-white at any hardware store for pennies. They are simply the small round brackets used for the ends of wood closet or curtain poles. Screw into place through center hole. A whittled plug can fill in open end of "leg."

Fixture Makes Compound-Angle Cutting Easy

THIS circular saw attachment frees you of the trouble of figuring out the angle of blade tilt and miter gage setting.

These are problems you encounter when sawing a desired compound-angle cut for picture frame or shadow box stock.

To cut a compound miter, first place the molded frame stock against the 45° fence, tilt the stock at the desired angle as in Fig. 1 and make the cut with the saw blade in the vertical position by sliding the fixture across the saw table. The stock is held at the desired angle of tilt by the adjustable tilt support unit (Fig. 2). Table A lists tilt support settings for various stock thicknesses and widths for use with 8 and 10 in. circular saws.



Mating compound-angle cuts are made on adjacent pieces of frame stock by using fixture supports at the right of the saw blade for one piece and supports at the left for the other.

TABLE A

8" 'BLADE

Having 1½ in. depth of cut above fixture base

Angle of tilt	Allowable width of stock (in inches)	Distance of tilt unit from fence
5°	4 5/8	4 1/4
10°	4 1/8	3 1/2
15°	2 7/8	2 1/4
20°	2 1/4	1 5/8
25°	1 7/8	1 1/4
30°	1 5/8	1
35°	1 1/2	13/16
40°	1 7/16	11/16
45°	1 3/8	9/16

10" BLADE

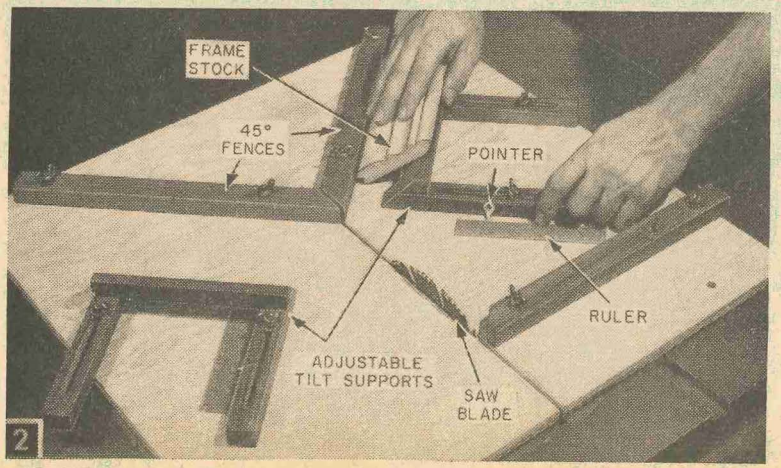
Having 2½ in. depth of cut above fixture base

5°	4 5/8	4 1/4
10°	5 1/8	4 1/4
15°	6 3/4	4 1/4
20°	5 1/8	2 15/16
25°	4 1/4	2 1/16
30°	3 5/8	1 1/2
35°	3 1/4	1 1/8
40°	3	13/16
45°	2 3/4	9/16

The allowable width dimensions applies to frame stock having an overall thickness of ¾ in. Thinner stock than this permits an increase in the allowable width and decreases where the stock exceeds the ¾-in. thickness. Depth of cuts greater than indicated for the above blades also increases the allowable width of frame stock which can be used.

Making The Fixture. Following the dimensions given in the Materials List, cut the fixture base and table slot bars to size. Since the slot bars must slide smoothly in the slots on your table saw, check the dimensions given for the slot bars we used to make certain they will fit your saw table. Assemble by placing the slot bars in the saw table slots and center the fixture base over the lowered saw blade and on top of the slot bars. Use glue and brads to fasten slot bars to underside of fixture base. Then raise the saw blade and cut the fixture base to within 6 in. of the rear side as in Fig. 3.

Make the three fences (Fig. 3A, B and C) and bore the pivot holes and ⅜ x ¾-in. slots in them. To locate the fences, bore the pivot holes in the

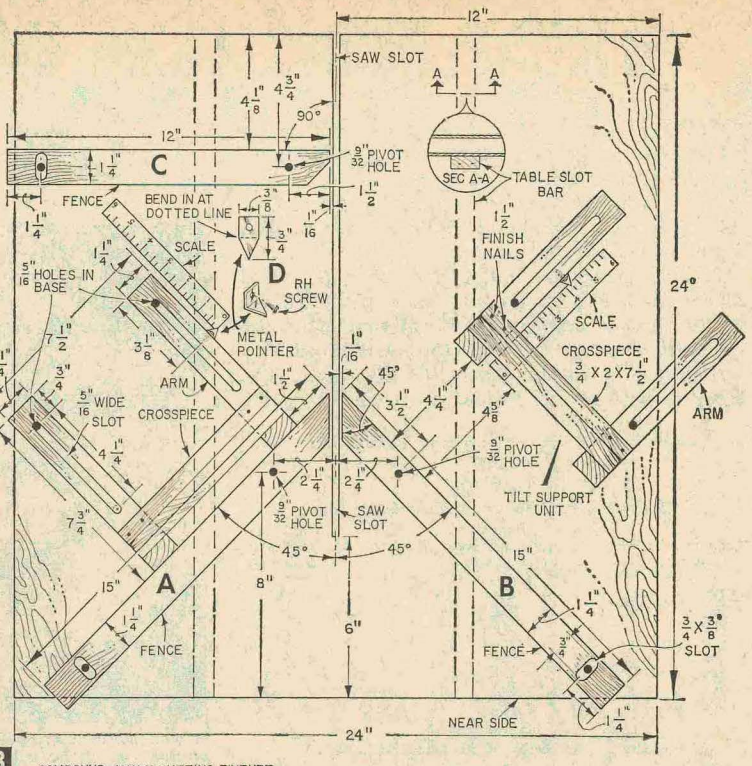


After setting the adjustable tilt support to hold the frame stock at the desired angle on one side of the fixture, set the tilt support on the other side of the saw blade so that both pointer settings on the scales read the same.

fixture base at the dimensioned points (Fig. 3) and mount the fences at a 45° angle in relation to the saw blade. Also mark the hole locations for the slots. Counterbore all holes on the underside of the fixture base for recessing the bolt heads.

After cutting the slots in the arms of the tilt support units (Fig. 3), attach the cross-pieces to the arms with glue and nails. Be sure the nails are set back far enough (Fig. 3E) to clear the saw blade when cutting the 45° bevel on the front ends of the units. To locate the holes in the base for the units, place the beveled edge against the fence as shown to the left in Fig. 3, and mark the location at the far end of the slots.

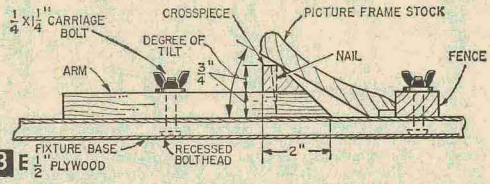
To accurately position the tilt support units, drill two 1/8-in. holes in the 6 in. scales and fasten them to the base as in Fig. 3 with #4 x 3/8 *rh* screws. Make two sheet-metal pointers as in Fig. 3D and fasten them to the sides of the tilt units and use as pointers to indicate the position of tilt units in respect to the A and B fences.



3 COMPOUND ANGLE CUTTING FIXTURE

MATERIALS LIST—COMPOUND ANGLE CUTTING FIXTURE
(all dimensions in inches)

No. Req'd	Description	Use
1	1/2 x 24 x 24 douglas fir plywood	fixture base
2	3/8 x 3/4 x 24 hardwood	table slot bars
2	3/4 x 1 1/4 x 15 hardwood	fences
1	3/4 x 1 1/4 x 12 hardwood	fence
4	3/4 x 1 1/4 x 7 3/4 hardwood	slotted arms
2	3/4 x 2 x 7 1/2 hardwood	crosspieces
10	1/4 x 1 1/2 carriage bolts, with wing nuts & washers	lock bolts
2	3/8 x 3/4 x 24 gage sheet metal	pointers
6	#4 x 3/8 rh screws	pointer fasteners
2	6 in. metal or plastic scale, graduation to read from left to right	scales



3 E

To adjust the A and B fences to make true 45° cuts, take two 2 1/2 x 12-in. scrap boards and cut the ends at a 45° angle using the A fence. Then check the cut ends with a 2-ft. square as in Fig. 4. Discrepancies can be corrected by loosening the bolt at the slotted end of the fence and changing the angle of the fence as necessary. Repeat the procedure until a perfect fit at the cut ends of the scrap pieces is obtained. Adjust fence B as you did fence A. Fence C, which is used as a general cut-off fence, is set at a 90° angle with the blade.

Coat the entire unit with linseed oil to reduce warping and apply paraffin to the table slot bars to ease the sliding action of the fixture as you push it across the circular saw table. Remember to slide the fixture back clear of the saw blade when removing it.—FRANK HEGEMEYER.

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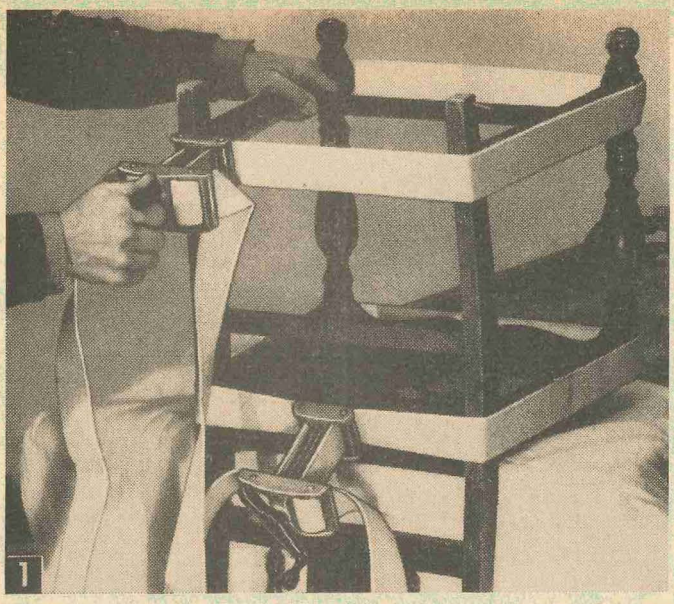
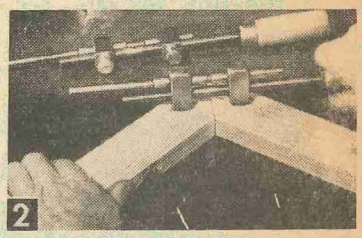
Check the accuracy of the A and B fence positions by holding test-cut pieces against a metal square and noting the gap (if any) at the ends of the 45° saw-cut edges.



Band clamps encircle chair legs, exerting even pressure for gluing in rounds. (Adjustable Clamp Co., 417 N. Ashland, Chicago 22, makes these clamps.)



Pins on jaws of this miter clamp enter holes bored in back and give even pressure at right angles to joint surfaces.

Holding tubing in floating vise, for cutting with carborundum disc. Block against screw gives rigidity to partly-cut tube. Float-Lock Mity Vise (AMF Tool Corp., 261 Madison Ave., New York 16) bears against miter-gage extension. This cutting should be done with a guard in place, though it is not shown here for purposes of photo clarity.

The Know-How of Correct Clamping

How to pick the right clamp for gluing butt, lap, or miter joints, locking pieces together for grooving or shaping, edge-gluing and veneering. Rapid one-hand clamping. How to figure clamping pressures and correct spacing

By EDWIN M. LOVE

FEW households would hang together very well or very long, if it weren't for clamps.

Whether your problem is one of repairing that wobbly chair (Fig. 1), building or repairing a picture frame (Fig. 2), or holding some work which you want to cut with a power tool (Fig. 3), you'll need clamps. And it will pay you to know how the home workshop "old pros" use different clamps for different jobs, and how they make do with the clamps they have, when they can't afford to buy special clamps designed for special jobs.

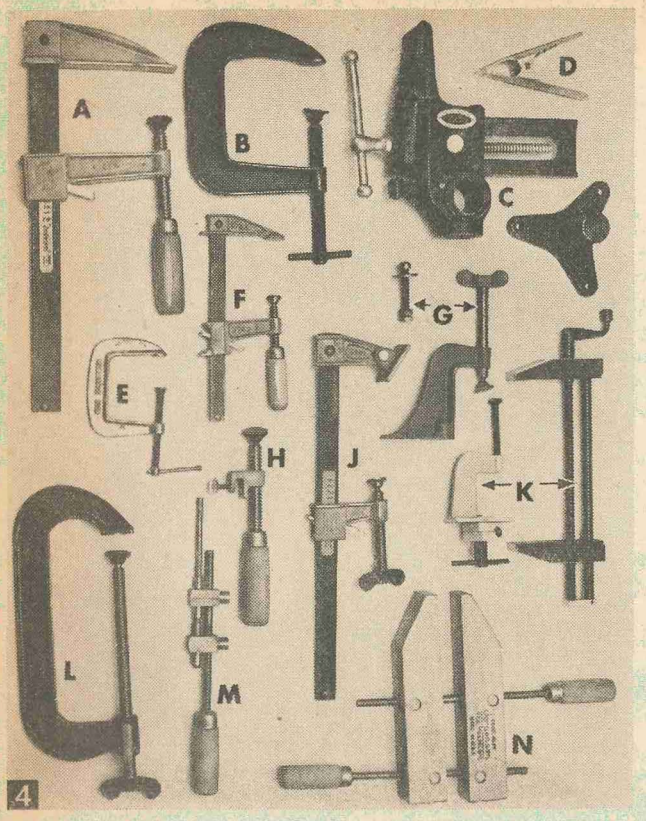
Here are some general tips about clamps and clamping which the "old pros" pass along. Don't buy clamps wildly. Choose a few clamps which will cover most of the regular jobs you do in the workshop, plus perhaps a few special types which best fit your particular hobby. Since clamps are made for hand pressure, don't pound them with a mallet or bar to increase leverage—you'll only end up with a broken casting or bent clamp backbone.

The deeper the clamp throat the more strain, so choose a size which most closely fits the work you are doing. Keep screws and cams cleaned and oiled for good service and long wear.

Figures 4 and 5 show you various types of clamps for different jobs. Note that the typical long bar clamps shown in Fig. 5 include clamp sets which screw onto common black pipe or mount on wooden bars—a cost-saving feature. Although any convenient length may be used, remember that stiffness decreases with length.

The movable jaws on the long bar clamps are locked with toothed cams or hardened steel clutch plates. With the jaws reversed, these clamps may also be used for pushing. You can also obtain double-bar sets, which are useful for clamping thin boards when edge-gluing, the pipes being swung against the assembly to prevent buckling.

Cabinet Work Clamping. Wide parts of cab-



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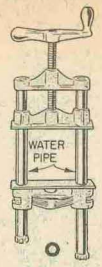
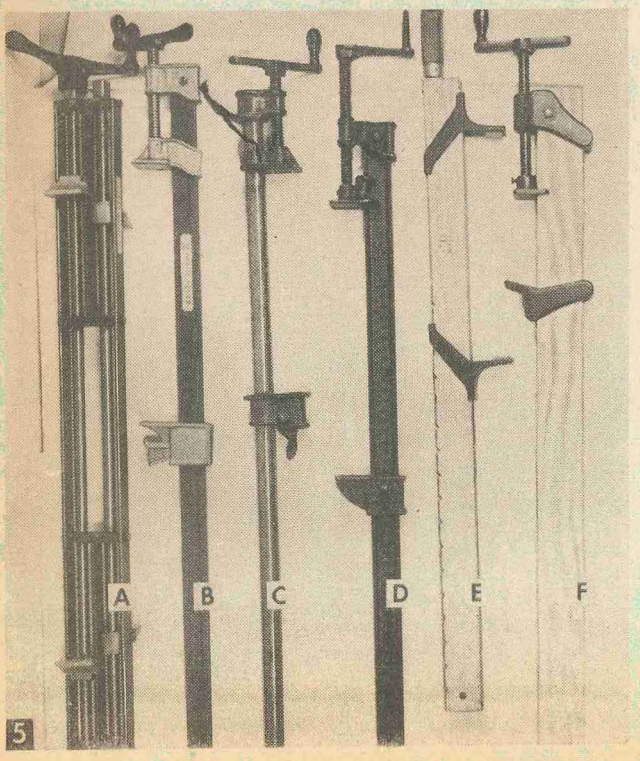


(A) Deep-throat sliding head clamp; (B) deep-throat C-clamp; (C) universal swiveling vise; (D) spring clamp; (E) light C-clamp; (F) lightweight sliding head clamp; (G) surface clamp; (H) edge clamp; (J) hinged clamp; (K) float-lock vise; (L) quick-acting clamp; (M) miter clamp; (N) handscrew; (O) double-bar clamp.

inets in solid stock are usually built up by gluing narrower pieces edge-to-edge (Fig. 6). How you do it will depend upon the glue used and the results wanted. Where you want flatness and are not concerned with grain appearance (as in a drawing board or bench top), use narrow strips, instead of wide. Alternate the heart and sap sides in the assembly (Fig. 7), but try to keep the grain in the same direction with respect to thickness. Ends of boards, with their open pores, tend to shrink more than the center, and removing a "shrinkage shaving" beginning and ending a couple of inches from the ends helps to offset this (Fig. 7).

While such glues as casein and white plastic hold quite well even with poorly-fitted joints and low clamping pressure, more pressure is required for urea glues and fish or animal liquid adhesives, and of course for good appearance in stained and natural finishes.

Pressure of 150-200 lbs. *psi* is desirable, which means spacing clamps for edge-gluing about 10 in. apart.



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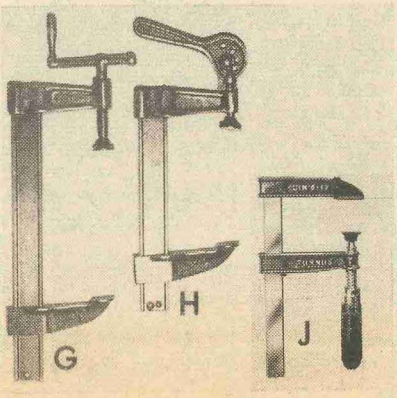
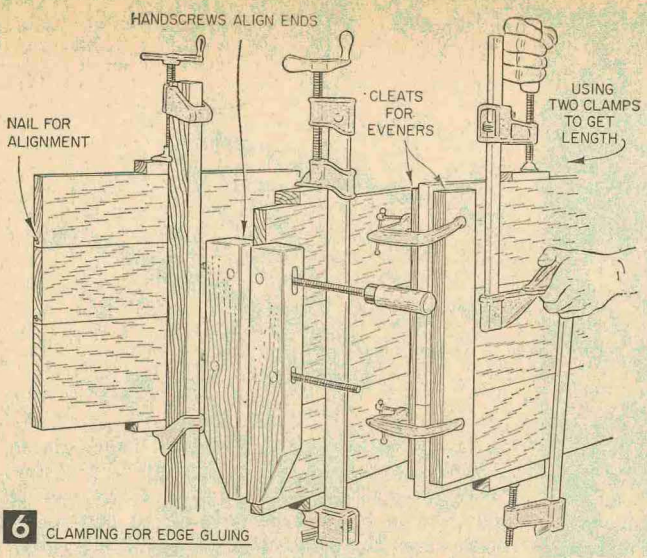
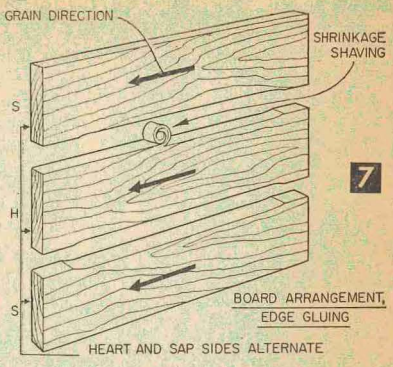
Some typical long bar clamps: (A) piling clamp; (B) fixed-head bar clamp; (C) clamp fixture on pipe; (D) fixed-head, eye-beam bar clamp with side notches; (E) wood bar clamp; (F) clamp fixture on wood bar; (G) fixed-head bar clamp with self-locking sliding jaw; (H) eccentric clamp; (J) self-locking head bar clamp.



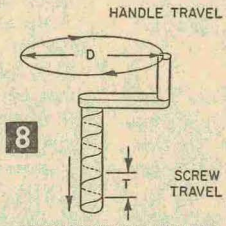


6 CLAMPING FOR EDGE GLUING



7 BOARD ARRANGEMENT, EDGE GLUING

Estimate the mechanical advantage of a clamp by dividing the handle travel by screw travel (Fig. 8). If the handle diameter is 6 in. and the jaw movement ⅛ in. per revolution, the theoretical advantage is $6 \times 3\frac{1}{7} \div \frac{1}{8}$, or 152. Allowing 50% for friction, the useful pressure is 76. A 20-lb. twist on the handle gives effective pressure of 1520 lbs.



8

PRESSURE EXERTED BY CLAMP

THEORETICAL MECHANICAL ADVANTAGE $= \frac{3\frac{1}{7} D.}{T}$

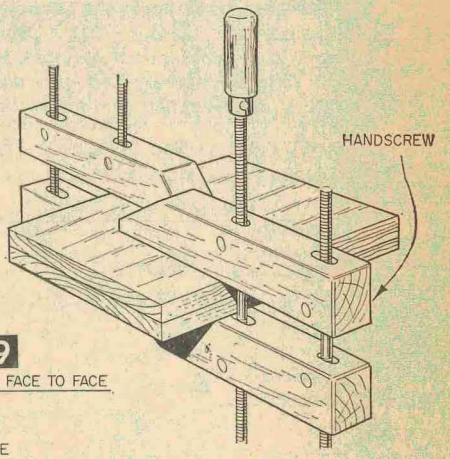
Table tops are sometimes thickened by face-gluing two or more boards (Fig. 9), or the edge may be built up to give the appearance of thickness. If two boards are used, join them with the grain running in the same direction as to width, but opposite as to thickness. If the pieces are crossed, you'll get warping because of shrinkage or swelling across the grain. Crossing the grain is good if three or some other odd number of thicknesses is used (Fig. 10).

Apply clamps with pressure at the center first, forcing glue and air bubbles out to the edges, afterward adding clamps at edges. Tighten the clamps again after a few minutes to compensate for absorbed glue. With handscrews, pressure can be distributed over a large area and no pads are needed. Parallel the jaws, spacing them to slip over the work, and tighten the end screws to force the tips of the jaws together. When all clamps are on, loosen the handscrews, tighten the center screws until pressure is exerted there while the jaw ends are slack; then tighten the end screws (Fig. 9).

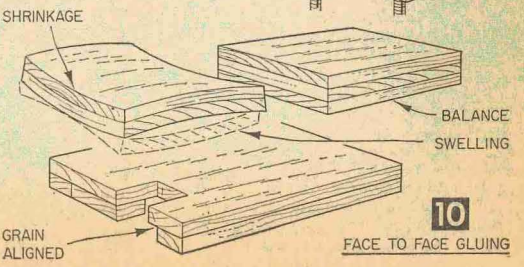
For such work as edge banding of table tops, bar clamps can be laid across the top if the span is not too great. If it is, edge clamps which hook onto the bars of other clamps as in Fig. 11 can be used. These exert pressure at right angles and permit clamping in a minimum of space.

Mitered Joints. There is no direct way to apply pressure on mitered joints with ordinary clamps. However, small frames can be held with a handscrew enclosing the side pieces while the ends are pressed together with another handscrew, but unless pressure is equalized one mitered end will slide upon the other. Figure 12 shows a fair solution, the notched blocks being drawn together diagonally while holding both ends of the joint. The holes in the center of the holding blocks keep the sharp corners from being crushed.

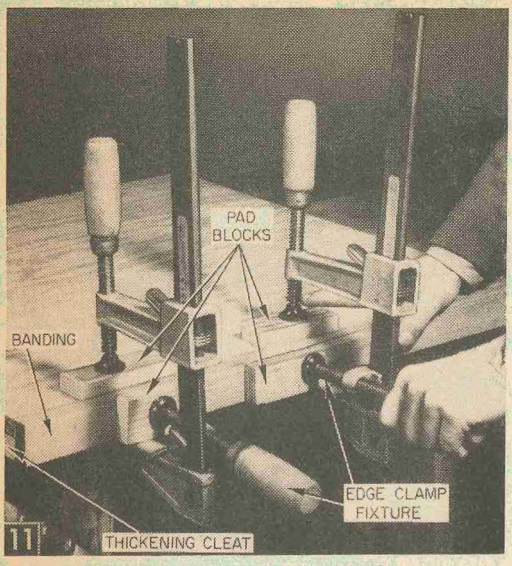
Figure 13A shows you some special clamps that hold the joint rigidly in alignment while the glue dries. Press the ends together as screws are tightened. Where more positive pressure is needed, and holes in the back of the joint members are not objec-



9 CLAMPING FACE TO FACE



10 FACE TO FACE GLUING



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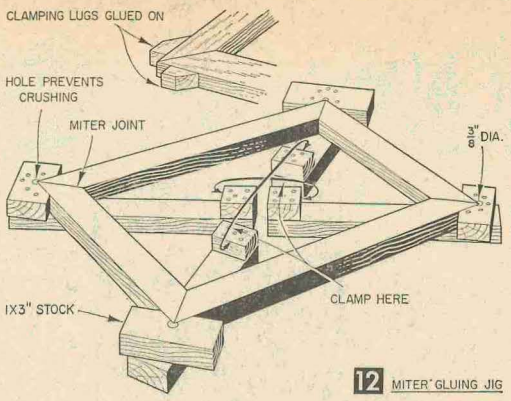
Clamping table-top banding with edge clamps. These can also hook onto the bars of other clamps to give pressure at right angles.



12 MITER GLUING JIG

tionable, the miter clamps shown in Fig. 2 are excellent. Simply bore holes to fit the jaw pins, insert them, and turn the screws to tighten. Clamp the pieces to a bench top or flat board afterward.

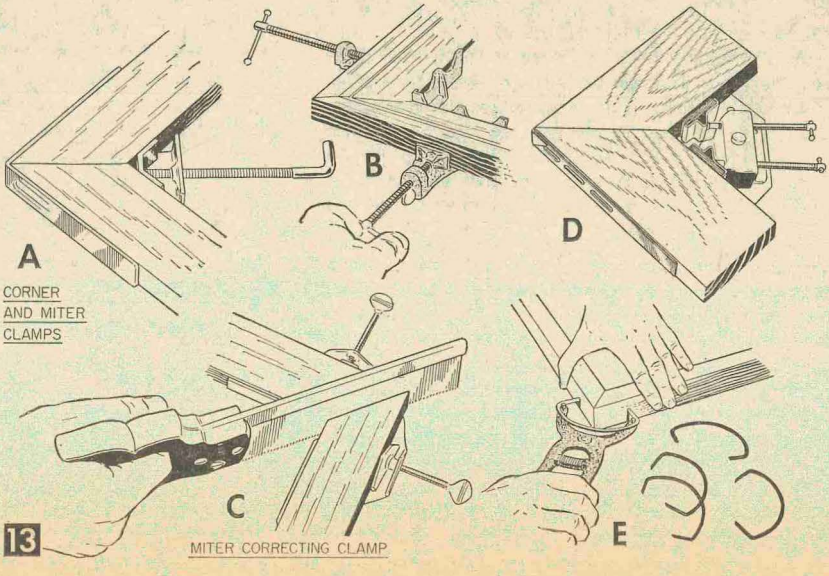
A poorly fitting miter joint can be corrected by using the clamp suggested in Fig. 13C. Clamp with miters touching and pieces flat on bottom and run a dovetail saw or back saw through the joint, paralleling the mitered ends. If one cut doesn't correct the joint, repeat the process.

Special spring-wire clamps (Fig. 13E), are sprung open with special pliers and can be applied to the mitered joints. You can use one or more clamps and often can also make them do double duty as hanging loops while the joints dry.

Odd Shapes. Figure 14 shows some ideas for clamping circular work with ordinary clamps. You can save material by assembling strips nested in layout and sawed out roughly before gluing. Scraps sawed from outer segments will restore straight edges for clamping, or cleats can be clamped on to take the jaws of bar clamps. In some cases handscrews are used as cleats. Miter clamps inserted in back holes are serviceable.

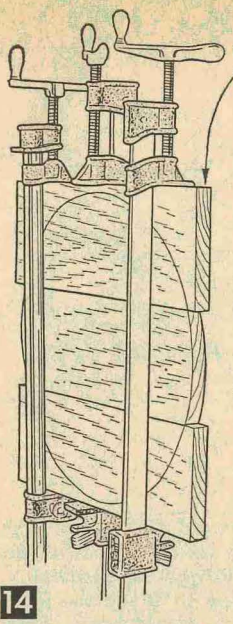
Note in Fig. 15 how a threaded steel pin, suitable for holding glued or dry joints, is being tightened with a nail set engaging holes in the spherical nut. Edge holes are bored for the pin and surface holes to receive the nuts. The wedge, shown at the right in Fig. 15, is especially useful for assembling counters, fixtures, and other construction made in a shop and installed on the job. Screw the hook members on at the proper angle and unite with the wedge, which is driven from the narrow end. A nail driven through the hole in the wedge prevents loosening. The assembly can be released instantly by driving the wedge back.

Such things as staved columns or round table aprons, difficult to put together with ordinary clamps, are easily drawn together with band clamps (Fig. 1). For round work, steel bands



13

(D) Professional corner clamp (Gunver Mfg., Manchester, Conn.) used for gluing miter-joint. (E) These spring steel clamps (Turnus Tools, East Hartford, Conn.) are attached to a miter joint by spreading with special pliers which comes with the clamp set.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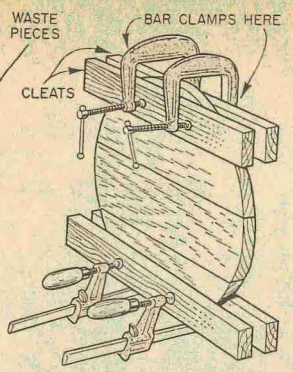
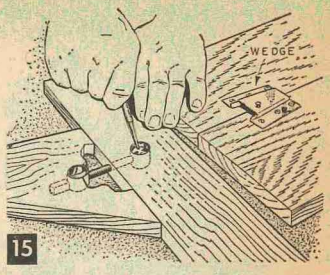


CLAMPING CIRCULAR WORK



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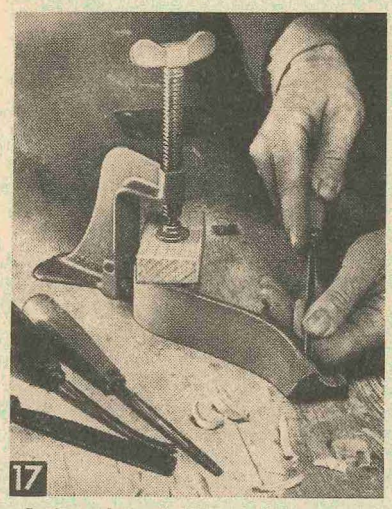
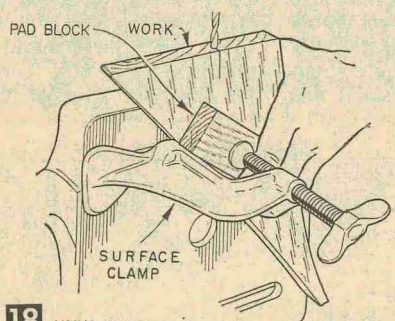
Dowel bolt consisting of threaded pin (see inset) is entered in edge holes and tightened by turning spherical nut with rod or nail set. Nuts lie in blind holes bored in back. This Tite-Joint Fastener, made by Hardware Specialties Sales Co., Los Angeles, can be used on glued and unglued joints.

can be used. Fig. 16 shows a hexagonal flower bowl being clamped, with cardboard pads protecting the edges of the angles.

Carving and Rabbeting. You can hold a piece to be carved or rabbeted solidly to the bench top with a surface clamp having a tee-groove in the bottom (Fig. 17). A special bolt inserted in the bench engages the tee-slot, but drops down flush with the bench surface into a counterbore when the clamp is removed. The same type of surface clamp will also hold a piece in a drill press for end-boring (Fig. 18).


17

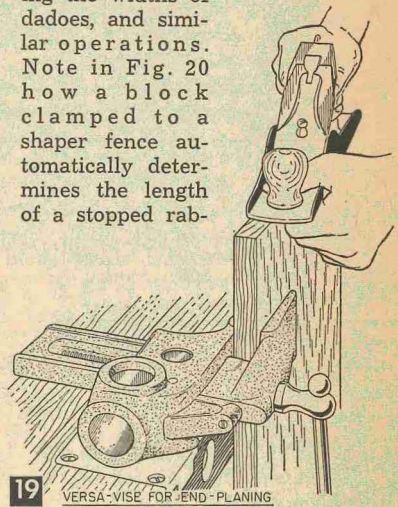
Surface clamp holding pediment scroll to bench top for carving.

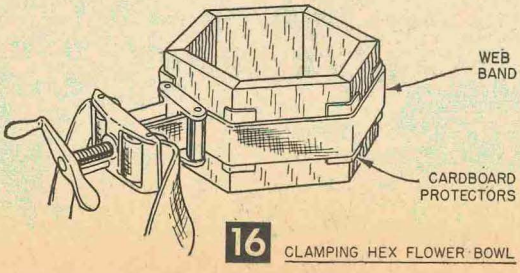


18 USING SURFACE CLAMP WITH DRILL PRESS

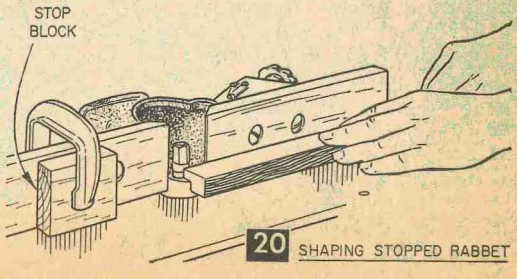
While older-style vises continue to be useful, modern versions which swivel and assume vertical or horizontal positions are very handy (Figs. 3 and 19).

To hold pieces to be screwed or nailed together, such as lap joints or stiles and rails for built-in cabinets, clamp them to jigs to hold them against cutter thrust, to move them in a true plane, and to keep the hands safely at a distance from the knives. Clamps hold all manner of gage blocks in machining pieces to be sawed to duplicate lengths, limiting the widths of dadoes, and similar operations. Note in Fig. 20 how a block clamped to a shaper fence automatically determines the length of a stopped rab-

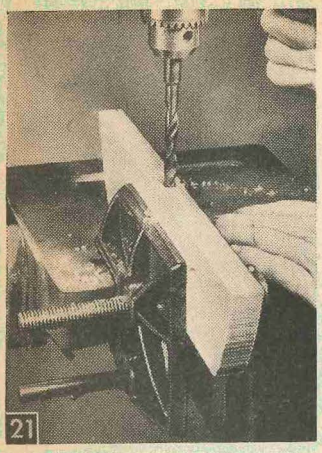

19 VERSA-VISE FOR END-PLANING



16 CLAMPING HEX FLOWER BOWL

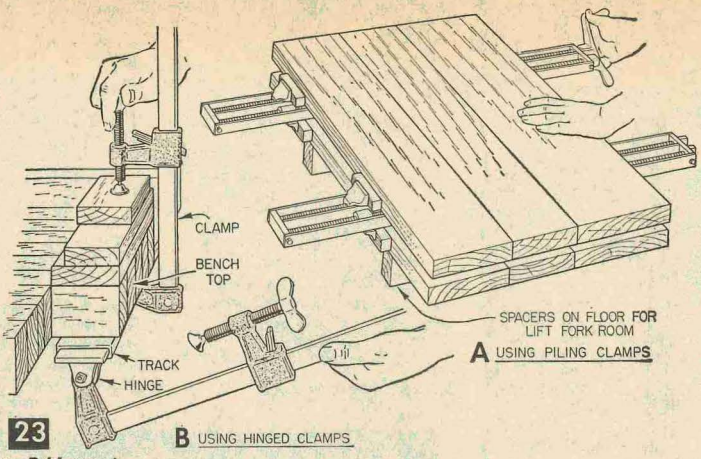


20 SHAPING STOPPED RABBET

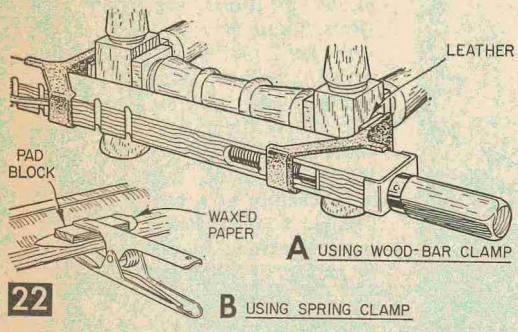


21

Using portable vise (Brink & Cotton Mfg., Bridgeport, Conn.) for boring dowel hole on drill press.



23 B USING HINGED CLAMPS



22 B USING SPRING CLAMP

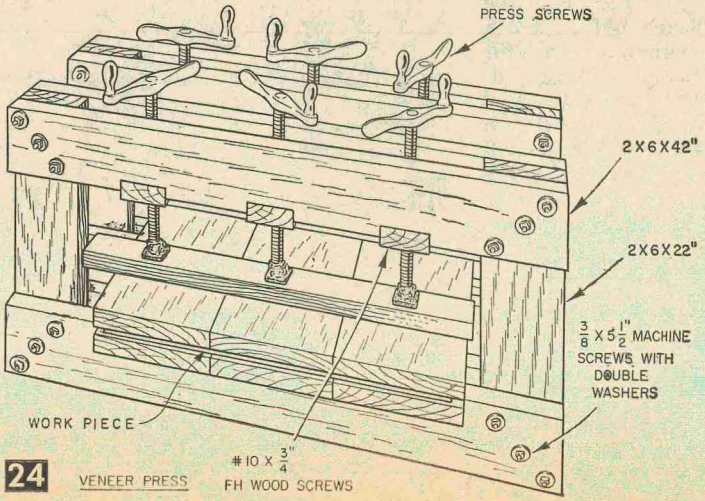
bet, or in Fig. 21 how a portable saw-horse vise becomes a handy drill-press tool.

Furniture Repairs. The notched wooden bar clamp with leather-padded jaws is less likely to mar finishes than the all-metal versions. Note in Fig. 22A how the clamp is used to hold stool legs to a stretcher while glue dries. A band clamp will hold the chassis of a chair together firmly (Fig. 1), without marring finish. Spring clamps, applied like clothespins, readily hold small bits of galleries or veneers being re-glued. Use a block under the jaw to prevent marring and a shred of waxed paper between the block and the work, to keep the block from sticking (Fig. 22B).

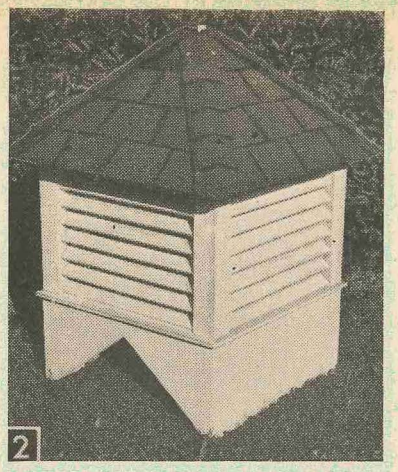
In production work, piling clamps permit stacking of glued boards on dollies to any reasonable height. A pair of jaws beneath clamps the under boards, and a pair on top grips the upper ones. The bars separate the glued parts by 1 in., for free circulation of air (Fig. 23A). Rapid-fire one-hand clamping is possible with hinged clamps which are screwed underneath a bench end or secured on a rail so that they can be slid where wanted (Fig. 23B). The work is laid on the bench, pad blocks in place, and the clamps swung up to working position.

Veneering calls for a press in which the work can lie flat and receive even pressure. Steel presses are for sale, but for the home shop one built of 2 by 8-in. stock, well bolted together, using press screws made for the purpose works well. Two frames are a minimum, spaced about 9 in. apart from center to center of screws, or about one screw for 80 sq. in. of gluing surface. As many frames as are needed are ganged together. Use 2-in. lumber for the covering boards or "cauls," and follow the ideas shown in Fig. 24 for construction.

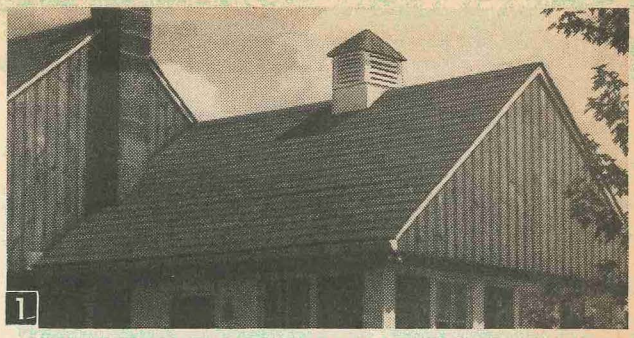
The press screws, which may be purchased from Adjustable Clamp Company, 433 North Ashland Ave., Chicago 22, Illinois, are available in 9-, 12- and 18-in. screw lengths. The screw nuts can be driven into 1-in. holes bored in the 2x4-in. cross pieces on the underside of the top frame members (Fig. 24). Screw pads are removable for assembly to press frames.



24 VENEER PRESS



Finished cupola showing trim boards on post corners and method of laying shingles.



A cupola looks best on smaller of two gables.

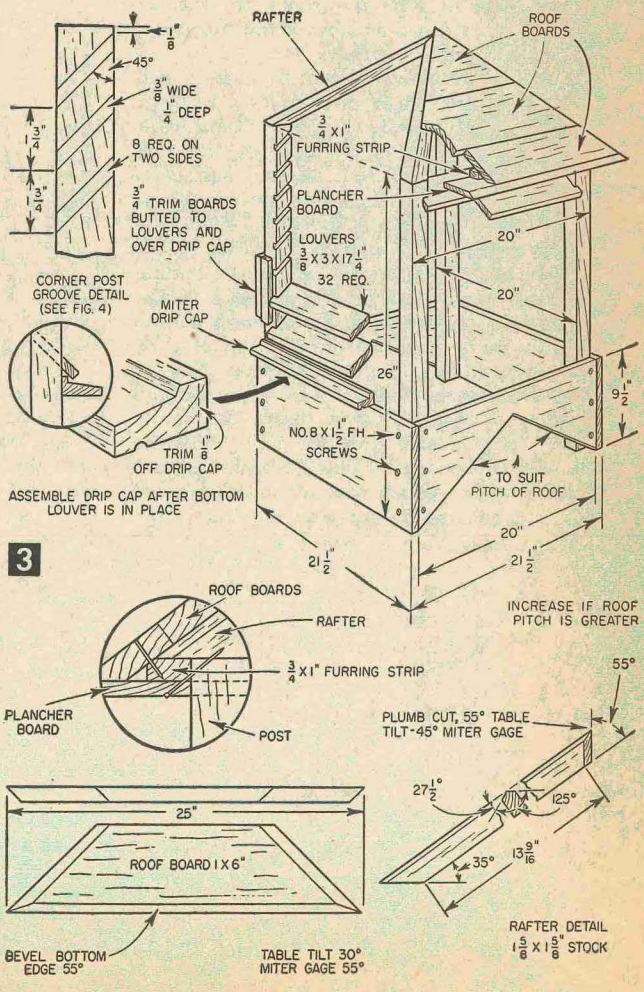
Dress Up Your Home With a CUPOLA

HERE'S a cupola that will not only add to the architectural styling of your home but also serve as originally intended—to ventilate and provide an escape for air trapped under a gable roof.

Start construction with the four corner posts (Fig. 3). Using clear, straight-grained white pine, lay out and saw the grooves for the louvers in two sides of the posts with a ⅜ in. wide dado head in the circular saw. Set the miter gage at 45° when sawing. Cut 32 louvers to dimensions given in Fig. 3. Make the four base pieces next, determining the V-shaped cutout from the pitch of the roof.

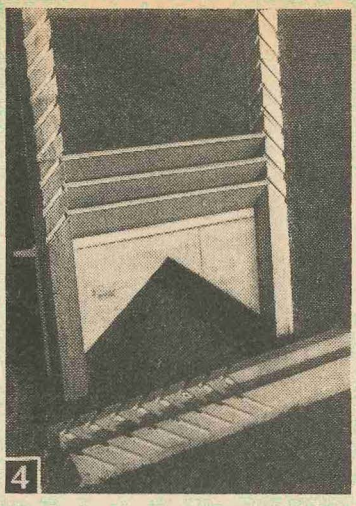
Assemble the parts made thus far, by fastening two corner posts to each base piece having the V-shaped cutouts, with three #8 x 1½ in. *fh* screws. Temporarily place two of the louvers in the grooves between the two posts to get the correct spacing before fastening to the base pieces.

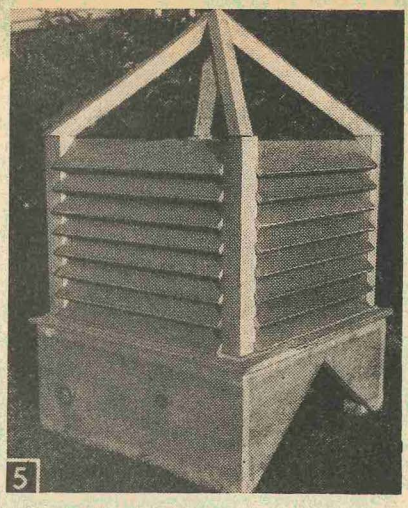
Trim ⅛ in. off a 12 ft. length of stock-size drip cap (Fig. 3), measure and miter cut the ends and fasten to the top edge of the base as in Figs. 3 and 5. Set the louvers in the grooves and toe nail in place. Now, assemble the two ends together by again temporarily placing two louvers between the posts on each side for spacers. Fasten the ends together with the other two base boards and three #8 x 1½ in.



fh screws. Measure and miter cut the ends of the drip caps (Fig. 3) but do not nail to the top edge of the base boards until the bottom louvers are in place. Insert the rest of the louvers in the grooves and toe nail in place.

Cut the roof rafters from 2 x 2 in. stock (1⅝ x 1⅝ in.) and saw the angle cuts (Fig. 3) on a circular saw. Make the plumb cuts where the roof comes to a peak by tilting the saw arbor or table 45° and the miter gage to 55°. Double bevel the top sides 27½° and assemble to the four posts as in Fig. 3 and 5 with the rafters extending ½ in. beyond the posts. Nail the ¾ x 1 in. furring strips (Fig. 3) in place and bevel the top outer corner to same angle as rafters.





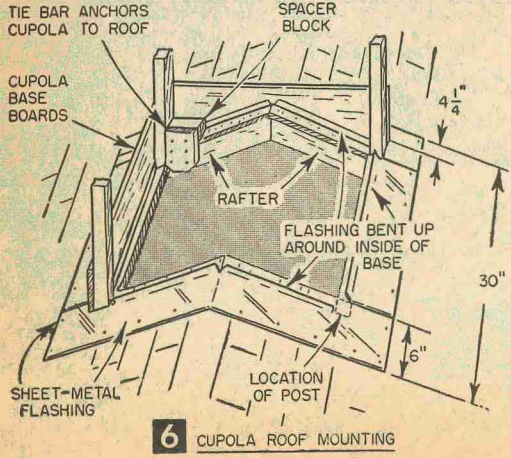
Left, assemble the two sides having the bases cut out for the roof pitch first. Right, roof rafters extend ½ in. beyond sides of posts.

Start covering the roof rafters by cutting and fitting the beveled edges on the long 1 x 6 in. bottom roof boards first (Fig. 3). Then work toward the peak, beveling the ends at the same angle as the long ones. Nail all roof boards in place and finish under the eaves with ⅜ x 3-in. plancher boards mitered at the ends. Plane the outer top edges of the plancher boards to the same angle as the roof boards. Finish by nailing ¾ in. thick trim boards to the outsides of the posts (Fig. 3) and saw off the bottoms of the posts at the same angle as the base boards.

If you intend to add a weathervane now or at some later date, drill a ½ in. hole through the peak and add a 2 x 2 in. brace diagonally across the posts inside near the top. Paint the cupola with one coat of outside white primer and follow with a finish coat of house paint of a color that will harmonize with the rest of the house. For shingles, use the same color and type of roofing material as on the roof of your home. Make them 6 x 11 in. in size and lay with 5 in. exposed. Make the cap shingles for the corners 4 x 6½ in. in size. Be sure to tack window screening over the louvers on the inside.

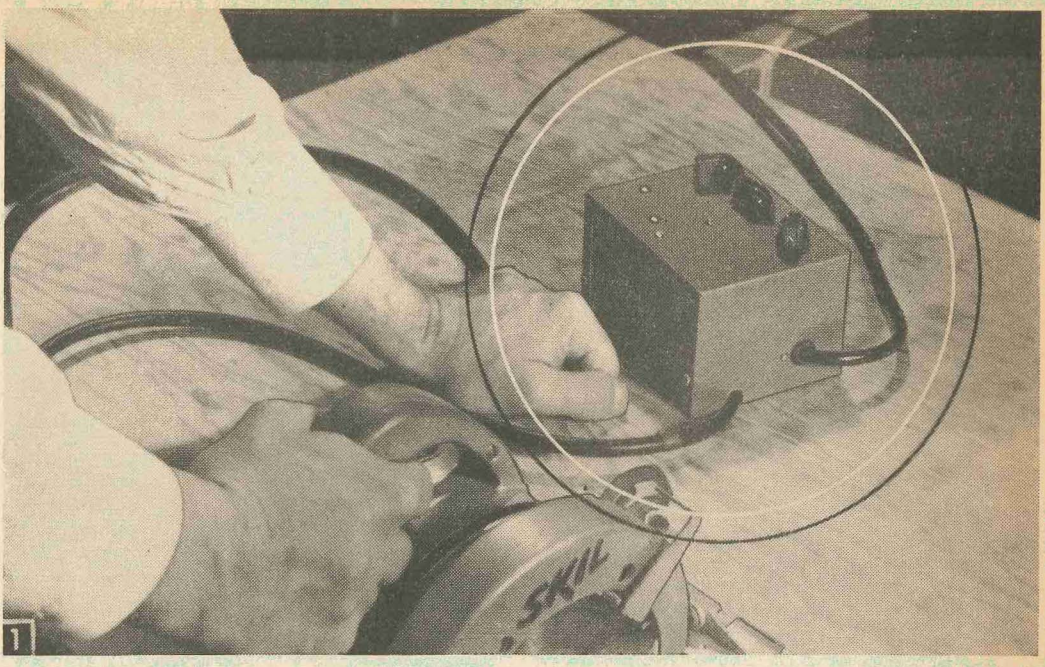
MATERIALS LIST—CUPOLA
(All dimensions in inches)

No. Req.	Size and Description	Use
4 pcs.	1⅝ x 1⅝ x 26 white pine	posts
2 pcs.	¾ x 9½ x 21½ pine	base
2 pcs.	¾ x 9½ x 20 pine	base
32 pcs.	⅜ x 3 x 17¼ pine	louvers
1 pc.	stock size drip cap 12-ft. long	drip cap
4 pcs.	1⅝ x 1⅝ x 30 pine	rafters
2 pcs.	1 x 6 x 120 pine	roof boards
4 pcs.	¾ x 1⅝ x 16 pine	trim
4 pcs.	¾ x 2⅜ x 16 pine	trim
4 pcs.	¾ x 1 x 22 pine	furring strip
4 pcs.	⅜ x 3 x 27 pine	plancher board
2 doz.	#8 x 1½ fh. screws	base
	nails, paint and roofing material as needed	



6 CUPOLA ROOF MOUNTING

Assuming that you are putting up your cupola on a finished roof and after deciding where you wish to locate it, mark off an opening with chalk 18 in. square between two rafters (Fig. 6). If your rafters happen to be 16 in. on centers, cut the opening 14 x 18 in. This will still allow adequate ventilation. Remove the roof cap for approximately 36 inches. Then with a linoleum knife, or other sharp tool, cut the shingles on the chalk line and with a keyhole saw cut out the roof boards. If there is a ridge pole, leave it intact. Lay four pieces of metal flashing around the opening as in Fig. 6 and nail in place. Seal the underside of the flashing with mastic as precaution against a beating rain. The cupola can be fastened to the roof boards by toe nailing through the flashing, or tie base and spacer blocks fasten to the cupola and roof rafters at each corner (Fig. 6) can be used. After nailing the cupola in place, bend up the flashing on the inside. Then replace the roof cap so that it butts up against the cupola on both sides.—V. Beckers and R. Dalton.



The Model I lock (circled) prevents unauthorized use of power tools. Note saw cord going into switch case.

Electric Locks

By W. F. GEPHART

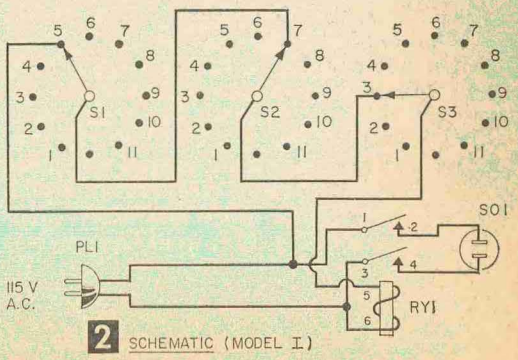
Three types of secret switches to lock control circuits of power tools. The "combinations" are simple, can be operated in the dark (by sound or feel), and can be changed readily

The switch shown in Fig. 1 is suitable in simple protective cases, such as preventing unauthorized use of dangerous power tools by children. As Fig. 2 shows, this Model I unit consists of three series-connected switches and a power relay. Once the three switches are set correctly, the relay closes and power is supplied to the outlet. The outlet is inside the box and the cord of the device goes through a notch in the edge of the box (Figs. 1 and 4), preventing the device from being unplugged from the "lock" and plugged into the nearest wall outlet.

The relay used must have a contact rating sufficient to handle the current drawn by the controlled device. To limit recognition of the combination, no scales are shown for the knobs. The unit is turned on by first turning all knobs to point straight down ("6 o'clock") and then counting the clicks or positions as the knobs are turned clockwise. The wiring of the unit is shown in Figs. 3 and 4, and the panel layout is shown in Fig. 5.

For greater protection, the single switch, multiple-relay Model II (Figs. 6 through 10), can be used. It also has a three-digit (9-right, 4-left, 7-right) combination, but a single knob is used and it has two safeguards to prevent unauthorized use. Understanding the operation of the circuit will permit changing the combination (see schematic, Fig. 7).

With the knob on "1," the power is turned on and all relays remain open. Turning the knob clockwise to "9" closes relay Ry2, which is held closed by voltage through its own contacts 3 and 4. If the knob is moved past "9,"



2 SCHEMATIC (MODEL I)

relay Ry1 will close to be held closed by its contacts 2 and 3, which will remove holding voltage from Ry2, allowing it to open. Relay Ry1 will remain closed until the power is turned off, preventing Ry2 from holding closed, even if the knob is moved back past "9." Relays Ry2, Ry3 and Ry4 must all be closed, and held closed, to complete the circuit to the controlled device, thus Ry1 is the first safeguard against improper use of the combination.

Assume that the switch was turned clockwise only as far as "9" (which closed and held Ry2), and then turned back to "4." This would close and hold Ry3, but if the knob was turned beyond "4" in a counter-clockwise direction, Ry1 would close and hold, releasing both Ry2 and Ry3.

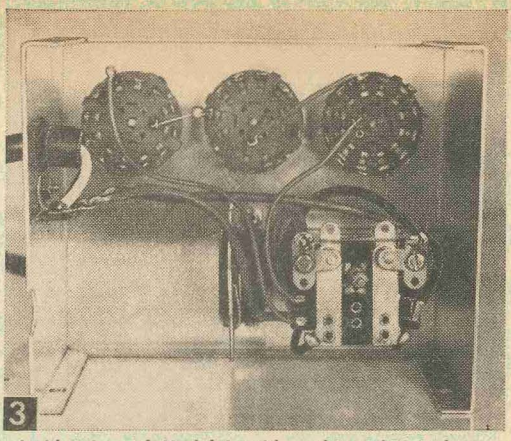
The third number in the combination is "7-right." However, position "7" on the C-section of S2 is connected to Ry1 through the normally-closed contacts of thermal relay Ry5, which is the second safeguard. If, after reaching "4," the knob is immediately turned right to "7," Ry1 will close and lock, releasing Ry2 and Ry3. Thermal relay Ry5 started heating as soon as Ry3 closed (when knob turned to "4"), but there must be a pause between setting the second and third digits of the combination to allow this thermal relay to heat up and open. The normal heating time required to open this relay is two seconds, although this period may be extended to three or four seconds by placing 1000-2000 ohms in series with the heater leads.

If, after turning to "4," the required pause is observed, turning right to "7" will close Ry4, which will hold closed. The circuit to the controlled device will then be completed through the open contacts of Ry1, and the closed contacts of Ry2, Ry3 and Ry4. At this point turning the knob in either direction will close Ry1, breaking the holding circuit to the other relays, allowing them to open and remove voltage from the controlled circuit.

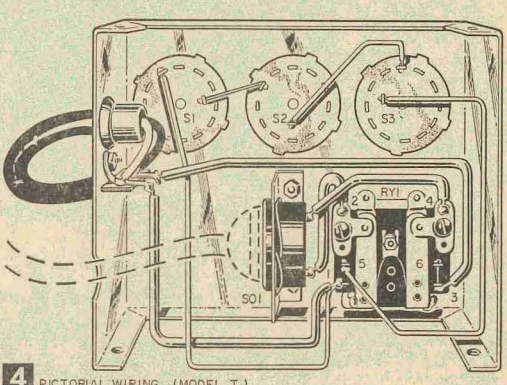
Contacts 1 and 2 of Ry1, and contacts 3 and 4 of Ry2, Ry3, and Ry4 must have the capacity to carry the current of the controlled device, as this current, as well as the holding current, flows through them. If the device is to remain on very long, these relays should also be rated for continuous duty.

This unit could also be used for a door lock with a solenoid-operated bolt, or for lawn sprinkler control with a solenoid valve.

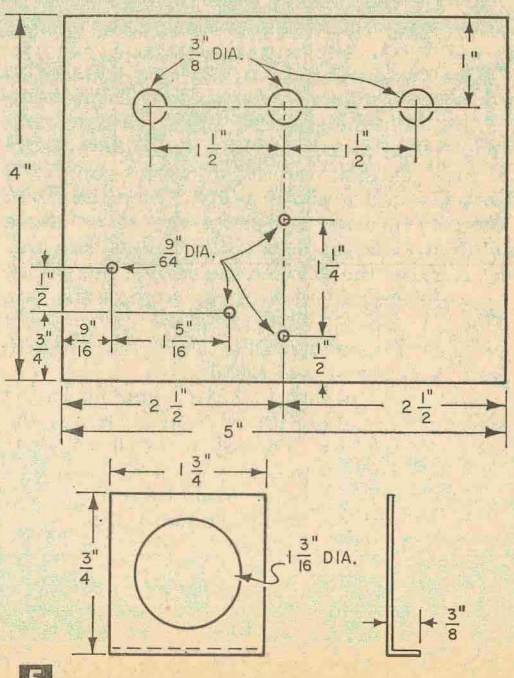
The Model III lock is the ultimate in protection and can be used to control a number of circuits. Normally, the dial, selector switch (S1), power switch (S2) and re-set light (PL), covered in Fig. 13A, would be separate from the main unit. The main unit (Fig. 13B) would be placed in a location centered around the circuits to be controlled and the remote unit located at a convenient spot, with an



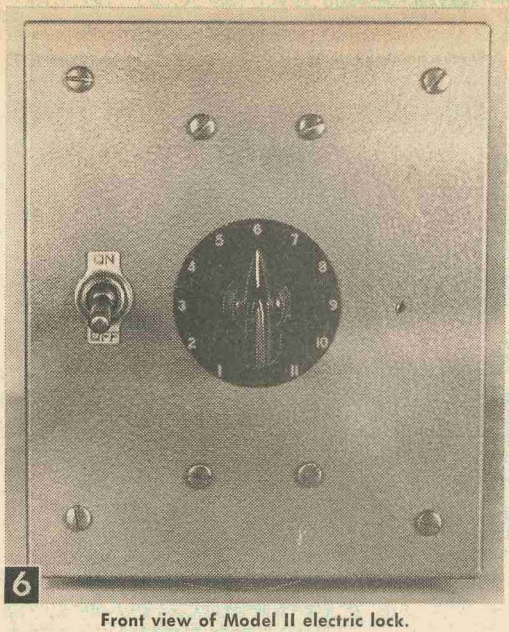
3 Inside view of Model I, with outlet socket in lower center.



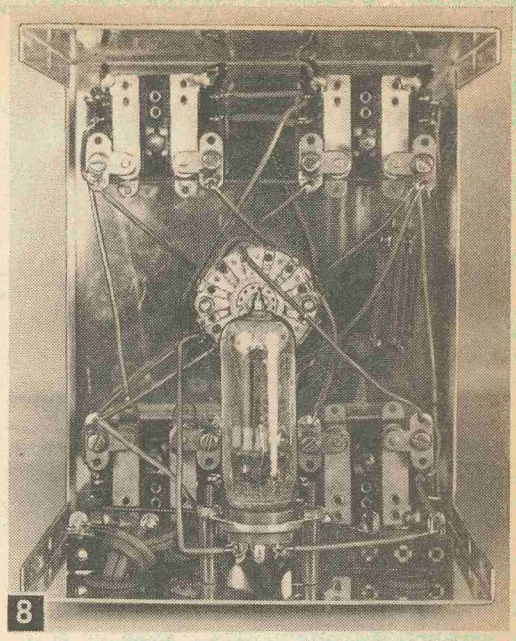
4 PICTORIAL WIRING (MODEL I)



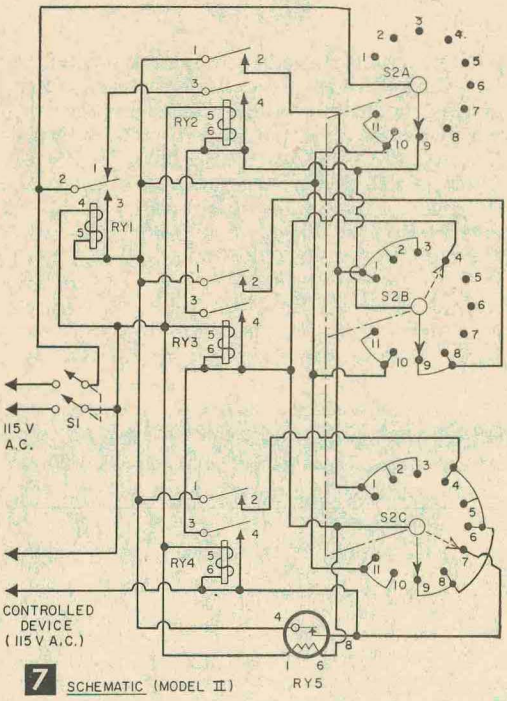
5 PANEL AND SOCKET MOUNT LAYOUTS (MODEL I)



6 Front view of Model II electric lock.



8 Inside view of Model II lock, showing thermal relay in center foreground.



7 SCHEMATIC (MODEL II)

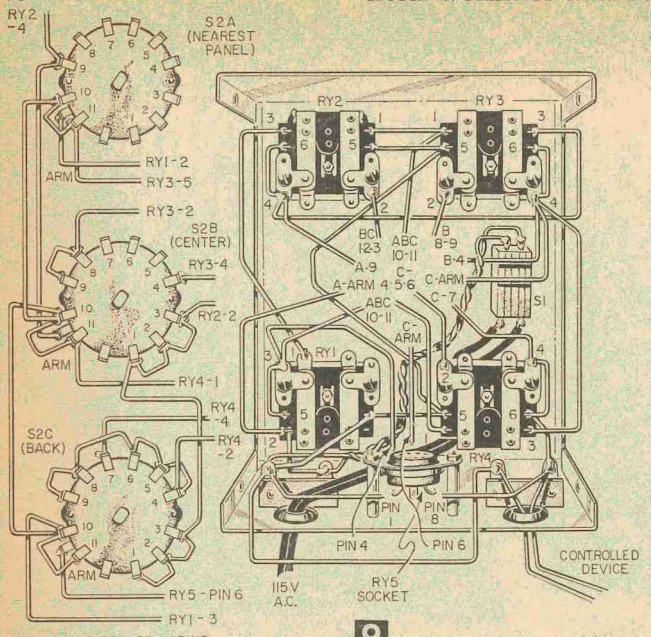
interconnecting cable between the units. The unit shown in Figs. 11 and 12 was built on one chassis for demonstration purposes.

In the Model III lock shown, four digit combinations are used and three circuits controlled. The numbers in the combinations are dialed, and dialing the wrong numbers will re-set the stepper relay (Ry3) to zero. If latching relays are used on the controlled circuits, one or more circuits can be left "on" while others are dialed. The 44-position stepping relay used will permit control of a number of circuits, and an understanding of the unit operation will permit change of combination and/or addition of circuits.

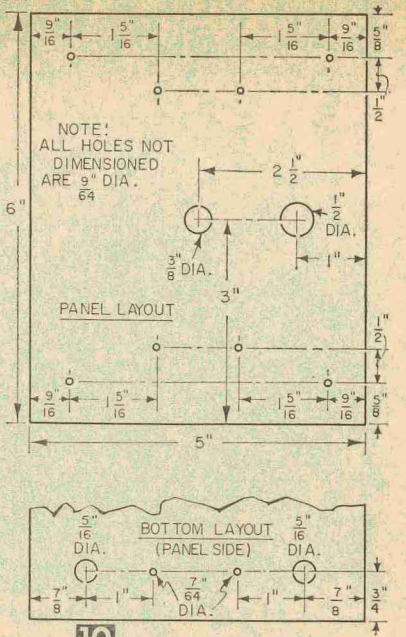
In Figs. 13A and 13B, relay Ry2 merely removes the power from the controlled circuits during dialing, so none will operate as the stepper arm passes the lower-numbered circuits. Without this relay, dialing the combination that ends on "28" would actuate circuits "A" and "B" as the stepper passed "23" and "26."

In the unit shown, circuit "A" combination is 9-6-3-8. Adding these numbers progressively, the dial will first move the stepper to "9," then to "15" (9+6), then to "18" (9+6+3), and then to "26" (9+6+3+8), which closes the circuit. Notice that leads from all of these positions go to the arm of selector switch S1a. The combination for circuit "B" is 6-6-4-7, and leads from the positions of the progression sum of this combination go to the arm of S1b. The combination for circuit "C" is 4-7-9-8, and the same wiring is used, going to the arm of S1c.

The dial has three sets of contacts, one of which opens and one which closes whenever the dial wheel is away from the "rest" position. The third set of contacts closes intermittently as the dial wheel returns to the "rest" position. The dial may have to be slowed somewhat to operate the stepper; this is done by loosening the screw on the small wheel that spins on the back of the dial. The



9 PICTORIAL WIRING (MODEL II)



10 LAYOUTS (MODEL II)

screw should be moved to the outer edge of the wheel and then tightened.

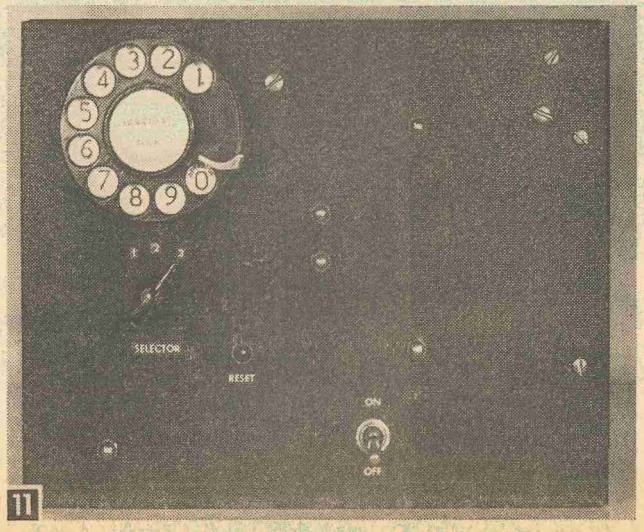
Here's the operation during the dialing of combination "A," for example, with the selector switch on "A," the power turned on, and the stepper at zero position:

As soon as the dial is turned to "9," the center dial contacts close, closing Ry2, and remove power from the common lead to the controlled circuits. The center dial contacts also put negative voltage on the stepper coil, holding it closed. The bottom dial contacts open, removing negative voltage from the upper arm of the stepping relay.

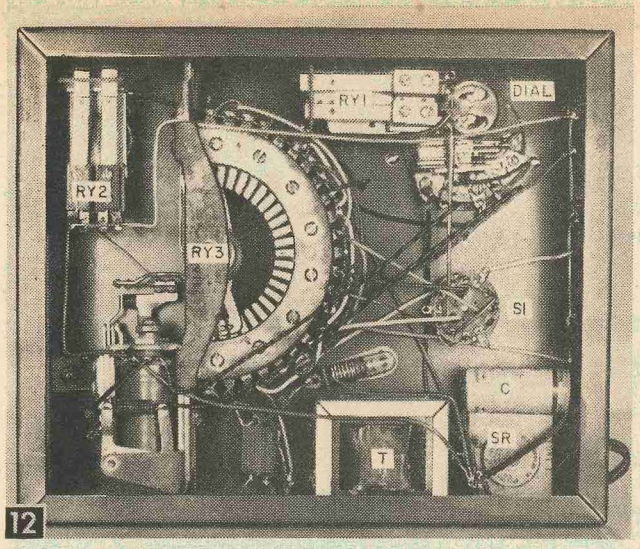
When the dial is released, the upper dial contacts open intermittently, breaking the voltage to the stepper coil, which advances the stepper arm one position for each pulse.

When the dial stops turning the stepper arm has reached "9." The center dial contacts open, releasing Ry2, and the bottom dial contacts close, putting negative voltage on the upper stepper arm. This has no effect, since selector switch S1 is on "A" and Ry1 is open. As the remaining numbers of the combination are dialed, the stepper arm moves in the same manner until the final digit places it on "26," which completes the circuit to the controlled device through the lower stepper arm.

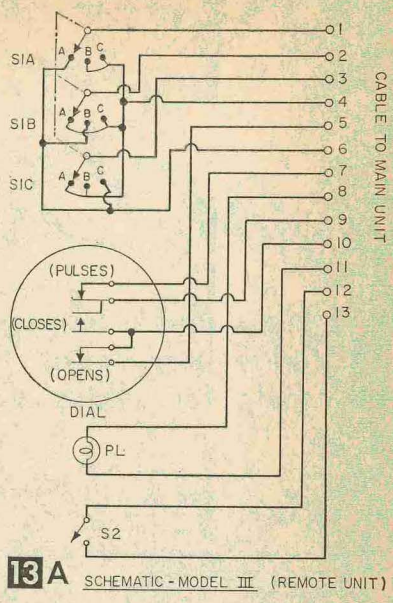
If a number is dialed incorrectly, and the stepper arm stops on a position not involved in the combination, the stepper will re-set to zero. In the case of misdialing, negative voltage placed on the stepper arm when the dial stops turning will flow through the common connections on the unused positions to the stepper relay coil through its own interrupter contacts. It will also close Ry1, which completes the circuit from the positions of the combination being used to the interrupter contacts. In this way, the stepper will pass the remaining proper positions for the combination, and return to zero. During the resetting cycle, Ry2 will



11 Panel view of Model III lock demonstration unit.



12 Back view of Model III, showing stepper relay (Ry3), dial and other parts.

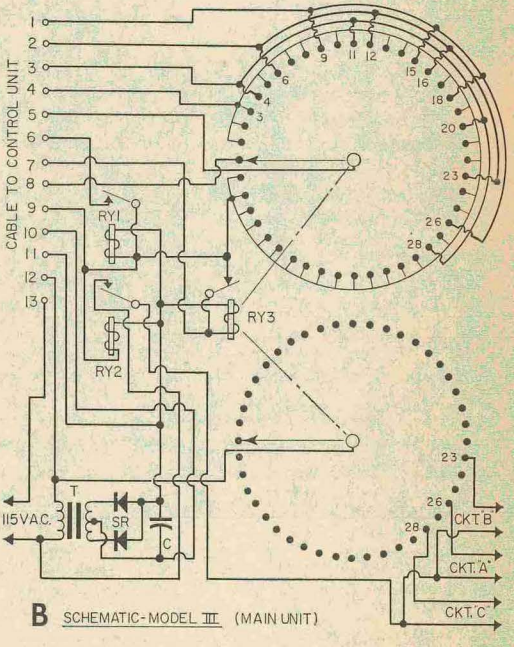


13A SCHEMATIC - MODEL III (REMOTE UNIT)

MATERIALS LIST—CONTROL CIRCUIT LOCKS

Desig.	Description
	Model I
S1, S2, S3	1-pole, 12-pos. rotary switch (Mallory 32112J)
Ry1	DPDT, 10-amp contacts, 115 v ac coil (Potter & Brumfield PS-11A)
SO1	female ac receptacle (Amphenol 61-F)
	3 x 4 x 5″ Minibox (Bud CU-2105) three knobs
	Model II
S1	DPST toggle switch
S2	3-pole, 11-pos. rotary switch (Centralab 1423, PA-1009 or PA-2009)
Ry1, Ry2, Ry3, Ry4	DPDT, 10-amp contacts, 115 v ac coil (Potter & Brumfield PS-11A)
Ry5	2-second, normally closed thermal relay (Amperite 115C2T)
	4 x 5 x 6″ Minibox (Bud CU-2107), 9-pin socket, knob, dial plate (Mallory Type 381), miscellaneous hardware
NOTE: Drilling diagrams are for above power relays, but other lower-priced units can be used.	
	Model III
S1	3-pole, 3-pos. rotary switch (Mallory 3234J)
S2	SPST toggle
Ry1	SPST dc coil, voltage equal to stepper relay (see text)
Ry2	SPDT, dc coil, voltage equal to stepper relay
Ry3	2-pole 44 pos. stepper relay, 6-12 v dc coil (see below)
dial	standard telephone dial (see below)
T	12.6-v, 1-amp filament transformer
SR	26-v, .7-amp half-wave rectifier (International Rectifier C1C1SDAGX), or 500 ma half-wave rectifier (see text)
C	500 mfd, 12-v dc electrolytic (Sprague TVA-1103)
PL	pilot light holder

NOTE: A stepper relay similar to the above, known as type SS-6 is available from Lafayette Radio, 165-08 Liberty Avenue, Jamaica 33, New York. Telephone dials and a wide variety of stepping relays are available from Soundtronics Labs., 630 Arch Street, Philadelphia 6, Penna.



B SCHEMATIC - MODEL III (MAIN UNIT)

also be closed, removing power from the controlled circuits. In this way, mis-dialing on any digit of a combination re-sets the stepper and voids the operation.

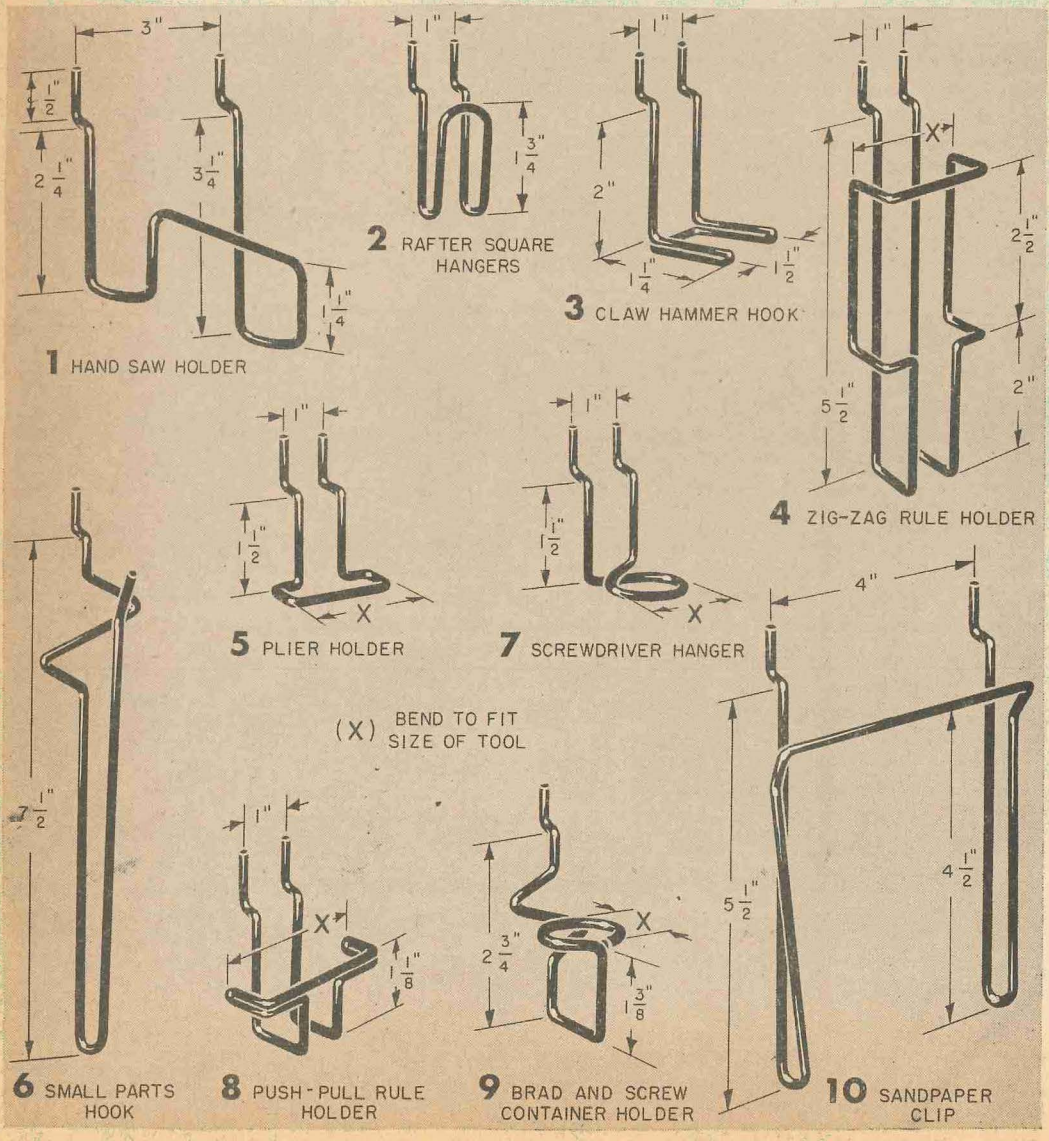
Relay Ry1 should be a fast-acting, slow-release type. Relays designed to these specifications are usually expensive, but an ordinary light-duty *dc* relay can be used by mounting it horizontally (so gravity helps hold the armature down), and reducing the spring tension to the absolute minimum.

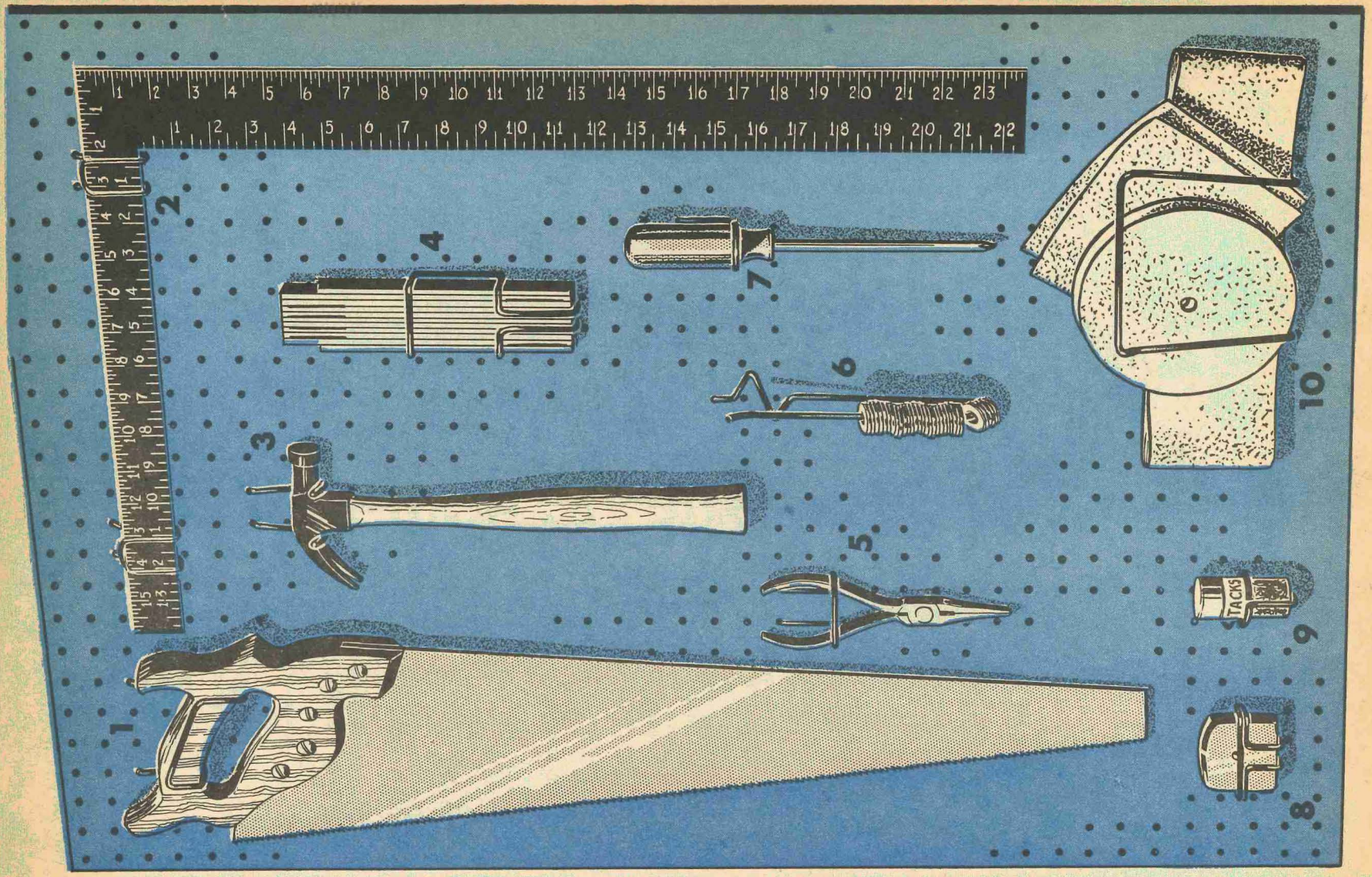
The stepper relay is available in several models, with varying numbers of positions and varying coil voltages. The one shown worked well on 6 *v dc*, but if 12 *v* is required, the transformer can be wired as an ordinary half-wave rectifier, and a single 500 *ma* selenium rectifier used. The re-set light serves as a reminder when mis-dialing occurs.

10 Special Uses... for Old Coathangers

Pliers and a few coathangers are all you need to make these peg-board hangers for those difficult-to-hang tools for which you cannot buy ready-made hooks

By Art Youngquist

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TACKS

How to Build an Authentic

Windsor Writing-Arm Chair

By NORBERT ENGELS

Photographs by Wally Kunkle

1

Seeming thinness of writing arm and seat is achieved by wide and deep beveling without sacrificing strength and rigidity where needed.

THOMAS JEFFERSON is said to have added the broad writing-arm and drawer for papers under the seat to this traditional Windsor-type chair. It was his favorite work chair and it doubled for serving tea and colonial snacks.

You'll need some patience and pride to reproduce its delicate yet husky proportions, and to carefully work out the compound angles of legs, stretchers and spindles.

Selecting the Wood. You have a fine choice of woods: birch, cherry, maple, walnut, Honduras mahogany and white pine—all were used in 18th century furniture.

If your local lumber dealer does not stock your choice, you can purchase it from Albert Constantine and Son, Inc., 2050 Eastchester Road, Bronx, N. Y., or Craftsman Wood Service Co., 2727 S. Mary, Chicago 8, Ill. Both firms specialize in fine woods or veneers precut and surfaced to various thicknesses and sizes.

Seat Construction. Glue up two layers of boards for a 1½-in. thickness, overlapping the joints as in Fig. 4B, and clamping generously.

After the glue has dried thoroughly, lay out the seat and cut it to shape as in Fig. 4A, taking particular care to locate spindle and leg-hole centers accurately. Scribe center lines and, if you plan to incorporate the optional decorative routing, include these guide lines also. Center-punch all holes to be bored—as you would with metal—for accurate drill placement.

For boring the compound-angle holes for spindles and legs, make a drill guide from scrap stock as in Fig. 5D. Set the angles indicated on Figs. 4A, 6A, B, C, and D as in Fig. 5E. Clamp guide as in Fig. 5F. Use a single-shank bit and put scrap under stock when boring to prevent splintering. If you use a drill press, set table for one angle and shim up scrap under piece for the other angle (wood shingles are ideal for this purpose); then clamp assembly to table.

Bore a pilot hole with a ½-in. router bit (Figs. 4A, 7A and B) as a depth guide for shaping the seat. You can bore other holes of vary-

2

This type of chair served in the 18th century as a writing-snack-rest combination—an idea which has been popular ever since.

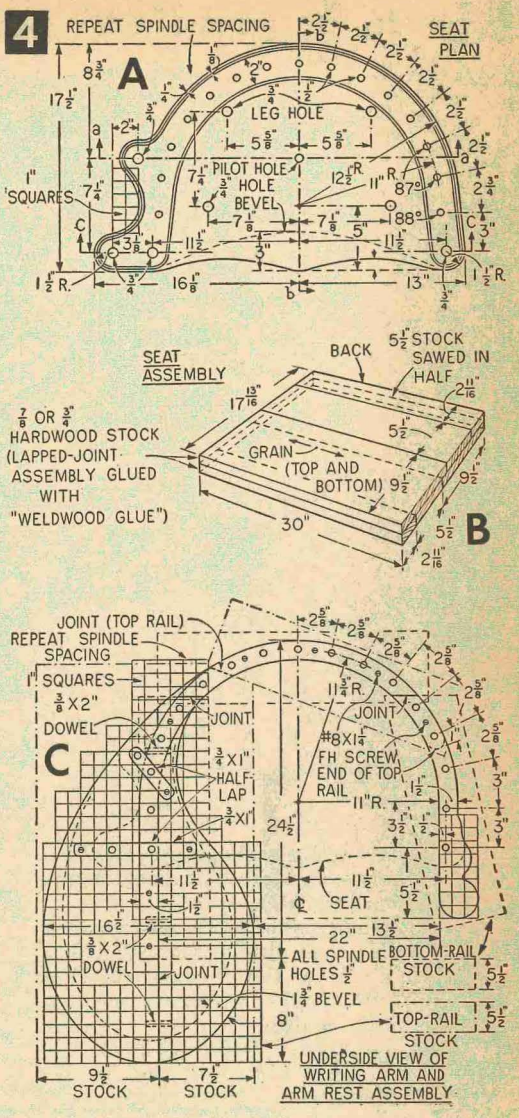
ing depths, using Fig. 7A, B and C as depth guides, to aid in determining contours of seat. Or, if you wish, cut cardboard templates to test shaping. However, these contours are not too critical so long as maximum depth is not exceeded (*finished* depth is ¾ in.). If you incorporate the decorative groove around the spindles, rout it on your drill press as in Fig. 8, or hand carve it with a ¼-in. wood-carving U-gouge.

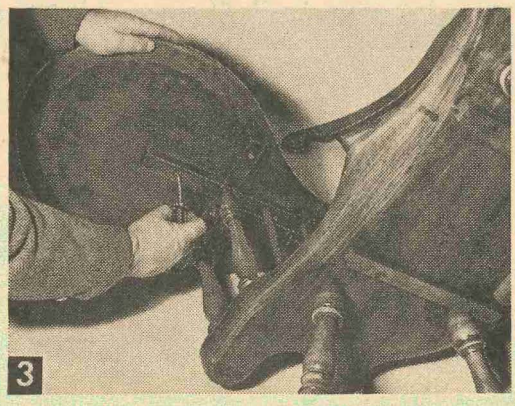
Next, shape the saddle (using a gouge with the grain) to the contours shown in section drawings (Fig. 7). The section lines are indicated on Fig. 4A. After roughing out these contours with a gouge, use a flexible rubber sanding disk in a portable power drill. For fast cutting, try silicon-carbide paper (grit 2½, then 1½, 1-0 and finally 2-0). After legs have been assembled and wedges driven, final sanding will be done by hand, working with the grain with 2-0, 4-0 and 6-0 garnet paper. Before hand sanding, use a convex-edged cabinet scraper for the saddle contours.

Bevel the front underpart of seat (dotted lines on Fig. 4A) to contour shown in Fig. 7B with a spoke shave (Fig. 9). Or, use a wood rasp for roughing out and then a 14-in. flat, bastard-cut machinist's file, finishing with garnet paper. Slightly round all edges with sanding block and sand underside of seat smooth.

Turn legs (Fig. 10), stretchers and rail-supporting spindles from stock to the dimensions indicated in Fig. 11A, B, C and D. Bore holes for side stretchers in front and back legs at angles shown in Figs. 6D and 11A. Also bore holes for the center stretcher in side stretchers at angles shown in Figs. 6C and 11B. After testing for correct angle and fit (Fig. 12), assemble with glue and drive in leg wedges (Fig. 6G).

Writing-Arm Assembly. Make two templates from ⅛-in. tempered hardboard (such as Masonite) as in Fig. 5A and C. If you first coat hardboard with flat white, all guide lines will show clearly.





Underside view shows how wide beveling of writing arm and seat front reduced unnecessary bulk. Cross-braces under writing arm are half-lap joined, glued, and screwed to writing arm for added strength.

After paint dries, lay out bottom rail-arm rest (Fig. 5A), scribing center lines, joint lines and spindle-hole centers (Fig. 4C). Saw out and bore 1/16-in. holes on spindle centers. (Later a 4d, 1½-in. finish nail can be used through these holes as a center punch to locate spindle centers accurately on glued assembly.) Bottom rail-arm rest is made up of three pieces of ¾-in. stock as shown in Figs. 4C and 5A. Locate template on individual pieces by using guide dimensions shown. Also, pencil in center lines on the stock as key lines for assembling. Saw out stock to guide lines.

Next, lay out template for writing arm-upper rail (Fig. 5C), using 1-in. squares as in

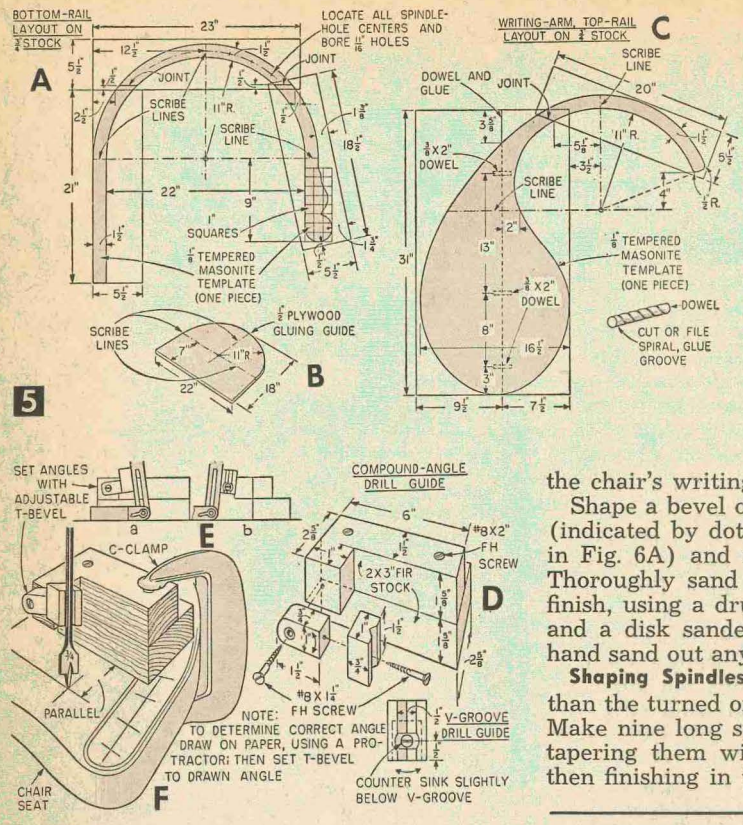


Fig. 4C for writing-arm contour. Scribe center lines as before and locate on stock using guide dimensions (Fig. 5C).

If other than mahogany is used for the chair, you may need to glue and dowel two pieces of ¾-in. stock for the writing arm (Figs. 4C and 5C). Only mahogany can be purchased in wide-enough widths from the sources previously mentioned. Saw out stock to guide lines. Cut an assembly gluing guide (Fig. 5B) out of ½-in. plywood. On a flat surface, tack down the template with a few brads. Apply rubber cement on surface and let dry. Then apply cement on cut-out writing-arm stock, let dry and cement to template, using the latter to locate glue-joined pieces accurately.

With the plywood guide, carefully locate segments of the bottom-rail arm rest on the writing-arm top-rail pieces. Glue-assemble bottom and top rails and joints, clamping generously until glue has dried. Then remove cemented template, rub cement off with your fingers and wipe stock clean with a gasoline-saturated cloth.

Locate writing-arm cross pieces and half-lap them flush with the bottom-rail piece, gluing and screwing them in place (Fig. 4C). Clamp bottom-rail template on bottom rail and transfer spindle centers onto stock with a 4d finish nail. Using the drill guide or a drill-press setup, with bottom-rail face *up*, bore spindle holes at correct angles (same as the corresponding seat holes — Figs. 4A, 6A and B) through rail assembly. *Do not bore holes through writing arm* for the three turned arm-supporting spindles and two dowel spindles between them (Fig. 4C). For added strength, drive #8 x 1¼-in. *fh* wood screws countersunk flush between spindle holes and into the chair's writing arm (Fig. 4C).

Shape a bevel on underside of writing arm (indicated by dotted lines in Fig. 4C and as in Fig. 6A) and round all edges (Fig. 6B). Thoroughly sand rail assembly to a smooth finish, using a drum sander for inside curve and a disk sander for outside curve. Then hand sand out any power-tool scratches.

Shaping Spindles, Top Rail. Spindles, other than the turned ones, are ½-in. birch dowels. Make nine long spindles as in Fig. 6, rough-tapering them with a spokeshave or knife, then finishing in the lathe with a flat, 14-in.

MATERIALS LIST—WINDSOR WRITING-ARM CHAIR

No. Req.	Size and Description
	Seat
2 pcs	¾ x 9½ x 30"
3 pcs	¾ x 5½ x 30"
	Writing Arm-Top Rail
1 pc	¾ x 9½ x 31"
1 pc	¾ x 7½ x 31"
1 pc	¾ x 5½ x 20"
3	⅜" dia. x 2" dowels
	Arm Rest-Bottom Rail
1 pc	¾ x 5½ x 21"
1 pc	¾ x 5½ x 23"
1 pc	¾ x 5½ x 18½"
1 pc	¾ x 1 x 9½" (writing-arm brace)
1 pc	¾ x 1 x 5" (writing-arm brace)
4 pcs	2 x 2 x 13 3/16" finished length (rail-supporting spindles)
	(Above pieces all in hardwood of your choice)
9 pcs	½" dia. x 30" dowels overlength (comb-back)
4 pcs	½" dia. x 15" dowels overlength (spindles through top rail)
2 pcs	½" dia. x 14" dowels overlength (spindles under writing arm)
1 pc	¾ x 3 x 32½" finished length (comb-back top rail)
4 pcs	2 x 2 x 19¼" finished length (legs)
4	3/16 x ¾ x 1⅜" hardwood wedges (for legs)
1	⅛ x 33 x 33" tempered hardboard such as Masonite (template, top rail)
1	⅛ x 27 x 27" tempered hardboard (template, bottom rail)
1	½ x 18 x 22" plywood (gluing guide for rails)
2 pcs	2 x 2 x 13¾" finished length (side stretchers)
1 pc	2 x 2 x 18¼" finished length (center stretcher)
	Drawer Assembly
1 pc	¾ x 3½ x 9" hardwood (finished front)
2 pcs	½ x 3½ x 10" plywood (finished sides)
1 pc	½ x 3½ x 8" plywood (finished back)
1 pc	¼ x 8½ x 9¼" plywood (finished bottom)
2 pcs	⅜ x ⅜ x 10" hardwood (finished runners)
2 pcs	¾ x ¾ x 10¾" hardwood (finished glides)
1 pc	¾ x ¾ x 9" (finished stop)
6	#4 x ¾" *fh* (flathead) wood screws
12	#4 x 1" *fh* wood screws
10	#8 x 1¼" *fh* wood screws (bottom rail-writing-arm assembly)

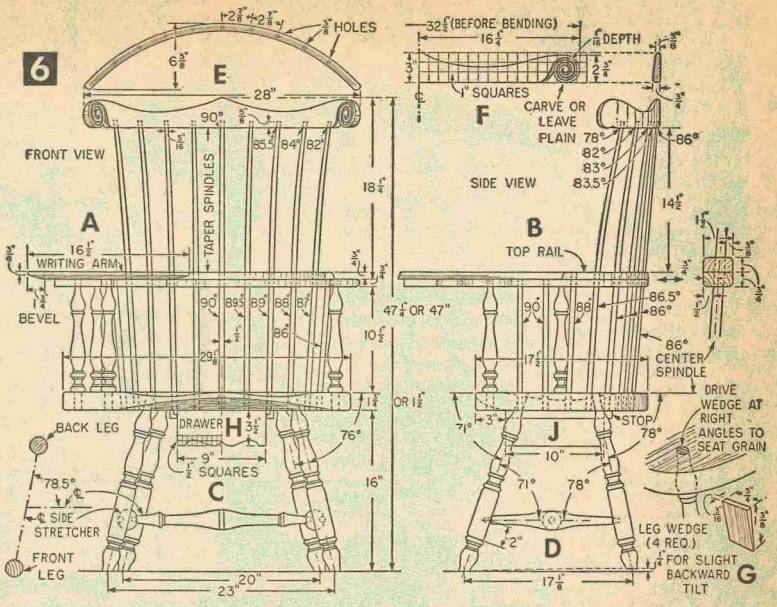
bastard-cut file and varying grits of garnet paper.

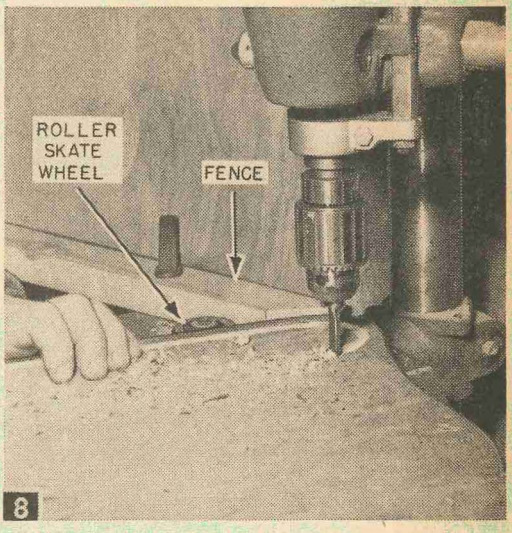
A steady rest of scrap wood with a hole bored through it for a spindle, can be clamped to the lathe bed to lessen any whipping tendency. Also, sand non-tapered portions of spindles for a light drive fit into holes.

Top rail of the comb-back (Fig. 6E and F) must be steamed and bent to shape. If you can obtain it, green wood is best for steaming and bending, as the steam softens the cell resins which become hard and brittle during kiln drying. Cut out to contour (Fig. 6F) and shape a bevel on the front face. Next, make a bending form as in Fig. 13A. The curve is of shorter radius than the finished rail to allow for spring-back of seasoned wood. If green wood is used, make the form radius 19 in. instead of 15 in.

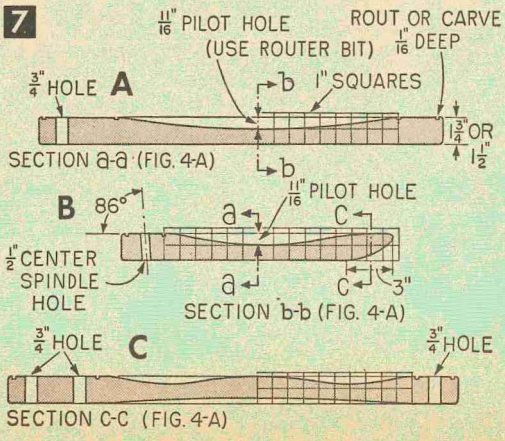
Prepare a steam box from a length of 4-in. steel pipe capped at one end (Fig. 13B). Fill with water to a height of about 20 in., suspend stock edgewise in pipe as shown and stuff rags in the open end. Elevate pipe on a stack of bricks and build a good, hot fire under pipe as shown. Do this outdoors, of course.

After steam-saturating the piece about one hour, remove and *immediately* clamp it in form (Fig. 13A). If piece doesn't bend readily, and without danger of cracking, steam it again. You must clamp the piece in the form within one minute after removing it from

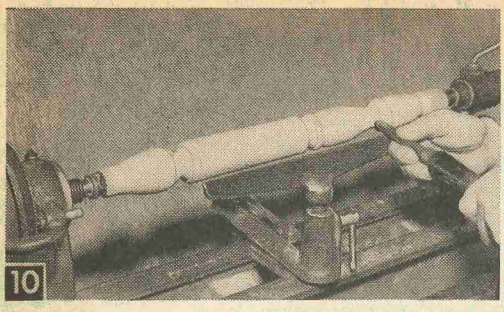




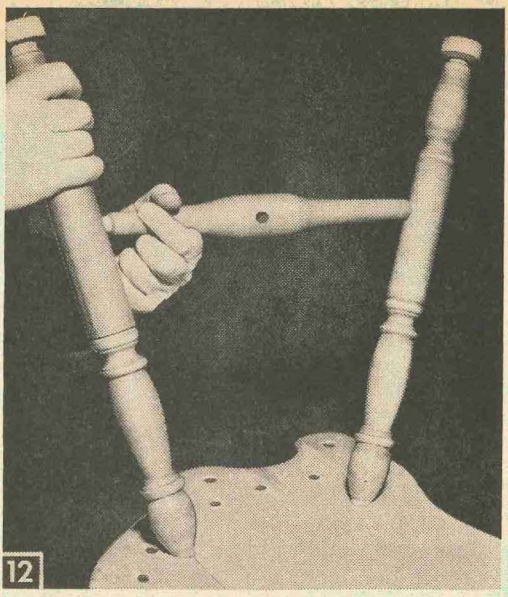
Routing optional decorative groove on drill press. Ball bearing roller-skate wheel is bolted through table and, with fence, guides router bit. Try set-up on a piece of scrap stock before routing chair seat.



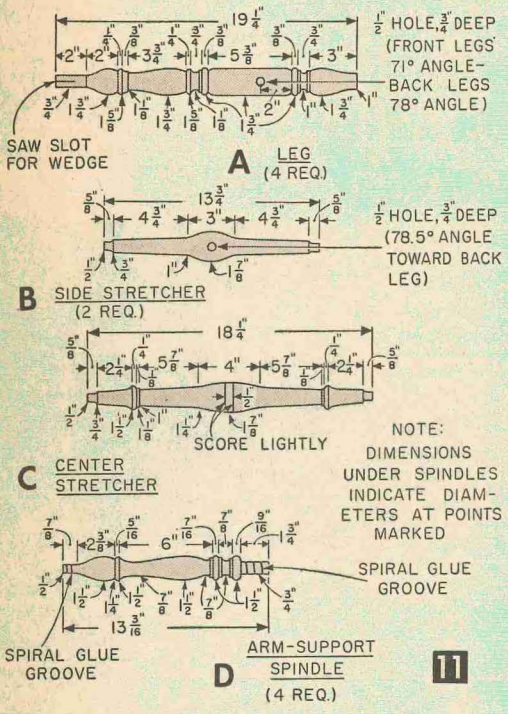
Roughing-out bevel on front underside of chair with a spoke shave, before finishing with a flat machinist's file and hand sanding.



Turning a leg in lathe. Finish by sanding with narrow strips of garnet paper of successively finer grits while piece is revolving. Move paper back and forth constantly while sanding to avoid scratches.



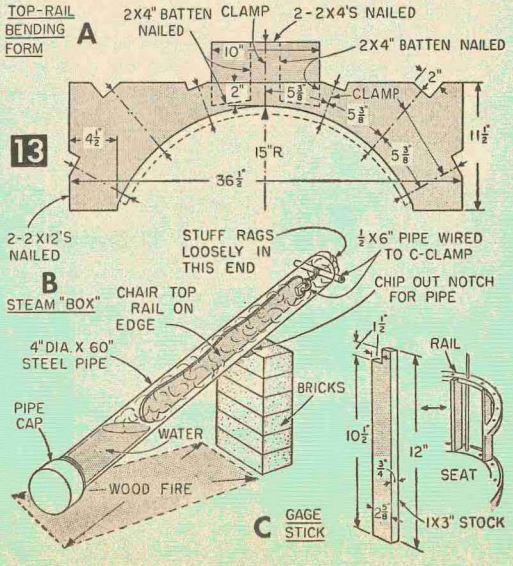
Trying out chair legs and stretcher for fit. Cut off excess stock on ends at correct angles after gluing and driving wedges. For a slight backward tilt, cut off back legs ¼ in. shorter than front legs.

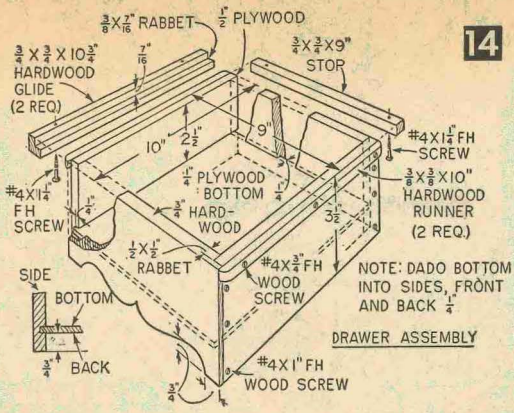


steam box, so keep your clamps handy. Leave it in the form until thoroughly dry—from 24 to 48 hours or more, depending on atmospheric conditions. When dry, and before removing form, bore ⅜-in. spindle holes as in Fig. 6E ¾-in. deep or ⅛ in. deeper than shown, to allow for adjustment of rail when setting onto spindles. These oversize holes bored at a 90° angle to back face of the rail, will allow for compound angles of spindle ends and glue.

Carve the scroll design (Fig. 6F) with a ¼-in. woodcarving U-gouge, or leave ends plain. Then sand piece to a smooth finish, rounding all corners.

To assemble spindles, start with turned rail-supporting ones and the two dowel spindles under writing arm. Glue them into the chair seat. Then place the rail assembly on spindles with glue. Using several gage sticks (Fig. 13C) to support the rail, drive in the dowel spindles, setting the short ones in glue at both ends and the long ones only at the seat. Protect dowel ends with a piece of wood when hammering. Sand spindles so a *light* tapping only is required to drive them; also make the short ones slightly overlength so they can be cut off flush top and bottom.





Lastly, tap comb-back top rail onto spindles set in glue, bending spindles by hand to meet holes (Fig. 6A and B).

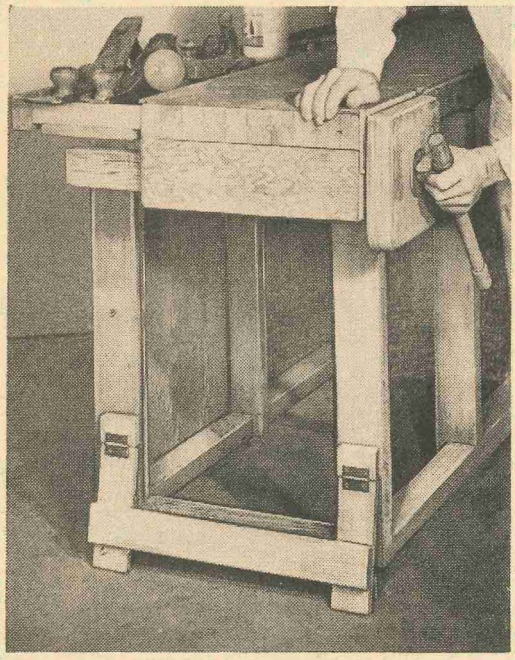
Make the sliding drawer as detailed in Fig. 14 and locate as shown in Fig. 6H and I.

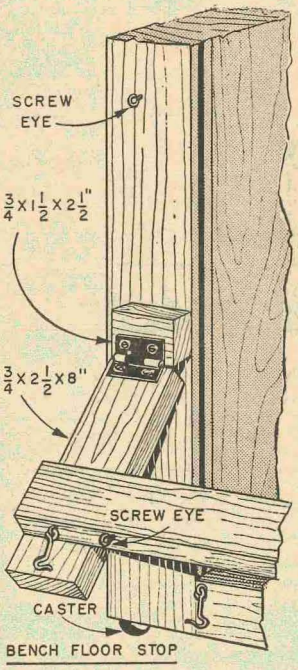
Finishing Pointers. After thoroughly hand sanding the chair to smooth, scratch-free surfaces, choose a stain depending on type of wood used and follow directions on label.

If you have used mahogany or walnut, fill the open grain with a paste wood filler slightly darker than stained wood and thinned with turpentine to the consistency of heavy cream. Apply with an old, stubby brush, brushing filler well into pores with and across the grain. When gloss has disappeared, wipe off with a piece of burlap or other very coarse material, across grain as much as possible.

One of many final finishing coats is white shellac thinned with an equal amount of alcohol. Apply evenly and let dry, rub smooth with 3-0 steel wool, clean and apply another coat, repeating this procedure. Let dry overnight.

When an even gloss appears, rub final coat with powdered pumice and pale rubbing oil for a satin finish. Polish with powdered rottenstone and oil if a higher polish is desired. A top-quality furniture polish can then be used to even out any variations in luster.





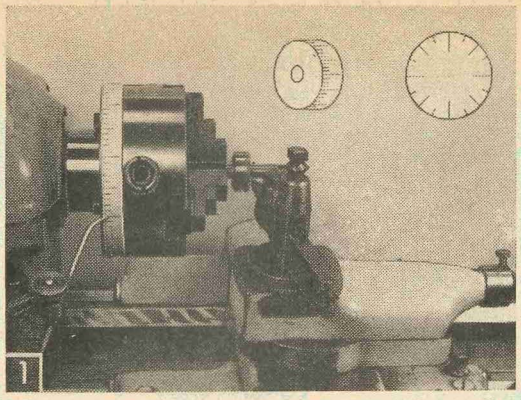
Making Your Workbench Portable

PUTTING your workbench on casters will double its usefulness. Not only will you be able to roll it out of the way when not in use, storing it in a spare corner or recess, but you can push it alongside the job. And with this simple stop you can lock it in position.

First, make two 2½ x 8-in. auxiliary legs of 1-in. hardwood for one end of bench, yoking them together with another 1-in. board. Hinge the upper ends to ¾ x 1½ x 2½-in blocks. To attach to bench, roll the casters onto a piece of heavy cardboard, rest the auxiliary legs on the floor, and nail or screw the hinged blocks to the bench. Back bench off the cardboard, then push forward until the legs contact the end of the bench—an effortless move because of the toggle effect—and they will carry the weight of that end of the bench.

Finally, install a hook on the yoke and an eye on the bench to lock the legs in the "use" position and prevent bench creep to the left. To roll the bench, release the hook and push the bench lightly to the right, freeing the leg assembly. Swing it up and hold there with a hook and eye conveniently located. The left legs of the bench are now resting on the casters and the bench can be moved by lifting the right legs slightly and pushing it along on the casters.—EDWIN M. LOVE.

Lathe Chuck Index



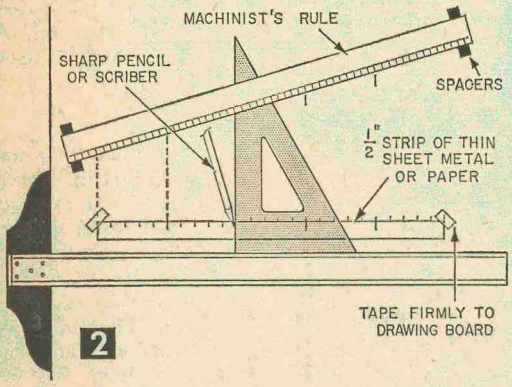
Fine line graduations are engraved on collars and dials with this lathe chuck accessory.

WANT big easy-to-see knobs and collars for your tools and measuring instruments? Or finely divided dials for radio and electronic equipment? You can make them by using your lathe as a "rotary engraving machine."

Accuracy of the method depends mainly upon the sharpness of your pencil, or scriber and, of course, the setups on the lathe must be solidly positioned.

You will need a ½-in. strip of tough flexible non-stretch paper, acetate or, for permanence, use thin sheet metal. Wrap the strip around the lathe chuck and cut it exactly equal to the circumference. Then tape it firmly to a drawing board, to mark it (Fig. 2).

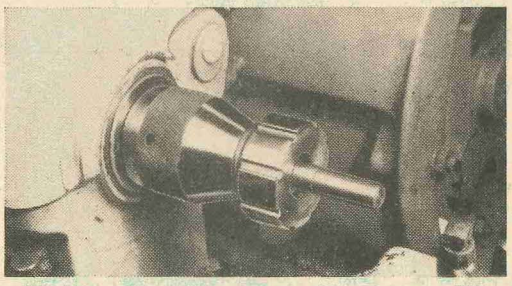
If you want to divide a collar into 25 parts, as on a micrometer cross feed dial for a lathe, use a machinist's rule divided into hundredths, or use a series of fractions of an inch that will give you the desired number of divisions. Mark the strip, either with fine pencil, or prick it with a sharp needle.



Now, fasten the strip around the lathe chuck with tape. The pointer can be improvised by clamping down a small surface gage, or you can fasten a pointer to the headstock casting. The work piece can be held on a mandrel, or in the chuck itself, and the marks are engraved with a sharp scriber held in the tool post, by moving the carriage back and forth.

For different lengths of lines, mark the lathe bed with pencil. Always sight the pointer carefully for maximum accuracy. The method shown can also be used for index drilling, inspection and other machining operations.—H. J. GERBER.

Lathe Collet Adapter

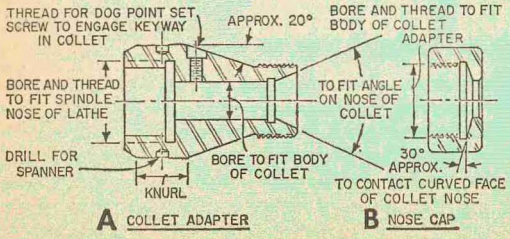


Chucking with collets means real accuracy. This adapter does the work of costly draw bar outfits, and handles bigger sizes.

THREADED to fit the spindle of your lathe, this adapter needs no draw bar, and thus extends the collet capacity of your lathe up to sizes that otherwise would require a larger machine.

With careful workmanship the adapter should equal the accuracy of your lathe itself. The principle is used on many big machine tools; instead of a draw bar pulling in the collet, the cap (Part B) pushes on the convex nose of the collet, enabling you to chuck larger sizes of bar stock, for precise machining.

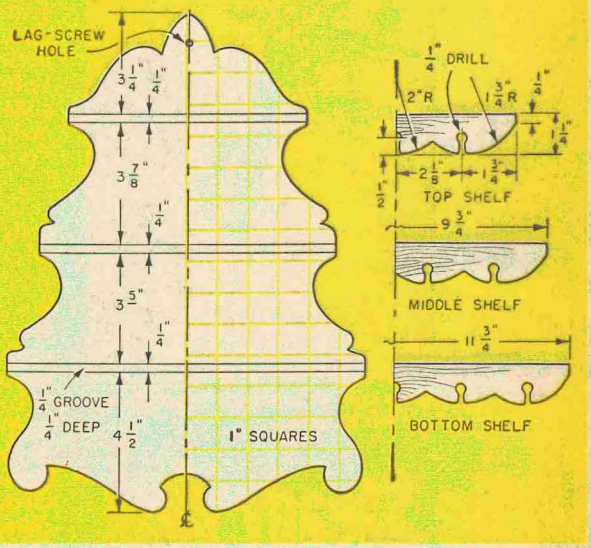
Plan your sizes according to the size of your lathe, and the collets you use, and then bore and thread part A to fit your lathe spindle. Then mount it on your lathe, and machine the O.D. and I.D. Next, (optional) case harden it for longer wear. Finish the bore and internal taper with a tool post grinder. The dog point set screw keeps the collet from rotating.



Machine the nose cap (B) and thread to match part A. Face the inside to match the curvature of your collets, or use an angle about equal to it. The outside slots are for hand grip, and spanner wrench use, and the nose cap can also be hardened.—H. J. GERBER.

One-Evening Projects

Colonial Spoon Rack



THIS craftsman's "quickie" is a guaranteed wife delighter.

First cut the three required grooves or dadoes in a ½ x 11¾ x 16-in. background piece of clear white pine. Then bandsaw out the squared pattern profile.

Although the three shelves vary in size and number of holes drilled they are all the same otherwise. Leave a ¼-in. straight-edge on each end of each shelf, where the shelf will fit into the groove. Then mark out scallops and drill ¼-in. holes as indicated, each centered ½-in. from outside edge. Saw a ⅛-in. channel from outer edge into drilled hole, rounding corners with either saw or file.

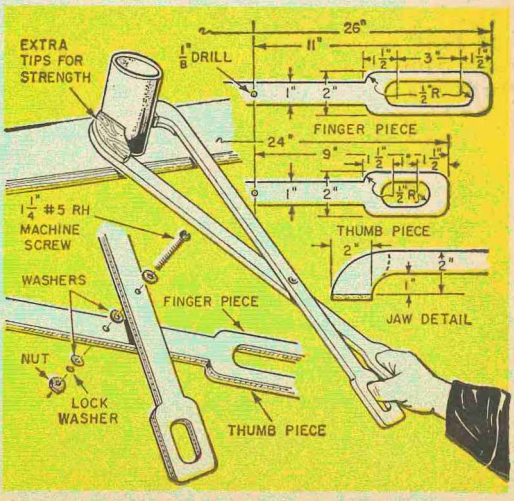
Glue shelves into grooves. Then sand carefully and apply stain and two coats of varnish, lightly sanded between coats. Rub boiled linseed oil and pumice onto the final coat, wipe clean and let dry 48 hours. Then apply second coat of oil, always rubbing with the grain.

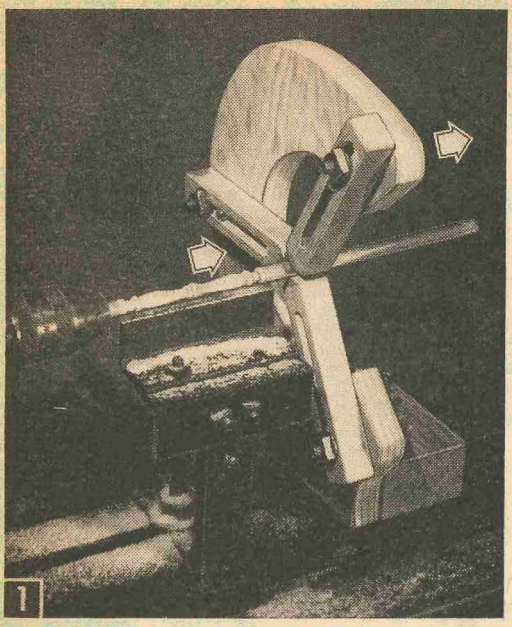
Attach rack to wall with a ¼-in. lag screw and insert a dozen decorative silver spoons in the shelf holes.—N.E.

Handy Grabbers

WHY keep climbing up on a stool to reach those high shelves, when you can make a pair of strong, lightweight grabbers in just a few minutes? They also put a very useful stretch into the reach of bed-bound convalescent patients.

Cut the grabbers out of ⅜-in. plywood as illustrated here. Glue on extra tips for both strength and double grip-ability, as well as to prevent what the dentists call *malocclusion,* that is, the jaws not meeting right. Cement a thin strip of foam rubber to the jaws to prevent slippage. Join the two pieces together with bolt and washers as in Fig. 2, and finish as desired.—ANTHONY EDWARDS.





Steady rest moves to right as spindle is turned from left to right.

Lathe Steady Rest

THIS steady rest will handle ⅛-4½ in. dia. stock, and prevent the vibration and whipping which spoils so many turning jobs on spindly stock. It will also hold the tailstock end of the work when turning or boring that end, eliminating the need for a tailstock center.

Make a full-size drawing of steady rest body (Fig. 2A) on ¾-in. plywood. Since lathe bed shapes and distance from headstock center to top of bed rails varies, take these dimensions directly from your lathe. For a *Shopsmith*, make dimension X on Fig. 2A an inch longer than center-to-center distance between the tubular bed rails.

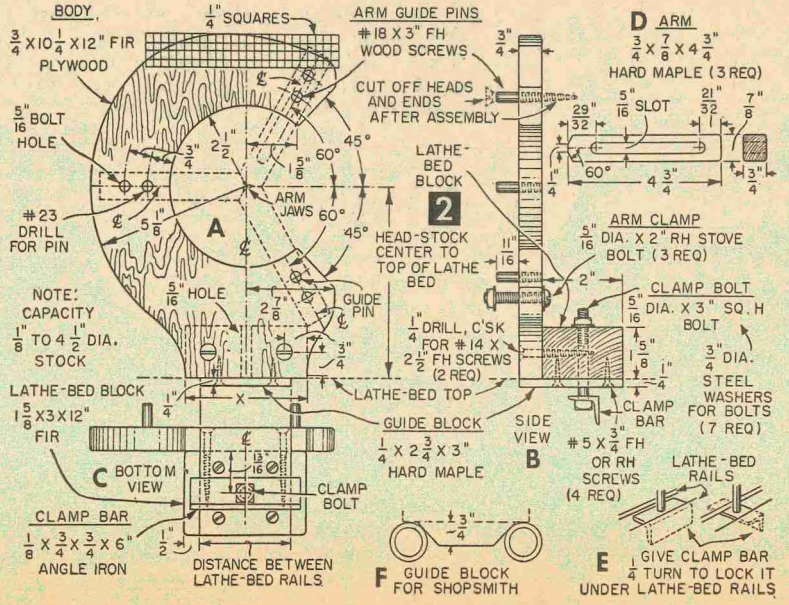
Scribe pencil centerlines on the body for arm pins and bolts, and a vertical centerline on the lower half of steady rest body. Carry this line around the bottom for centering the lathe-bed block on the body later. Saw out the body with a jigsaw or bandsaw and sand smooth, slightly rounding all sharp edges. Center punch-mark hole locations for pins, bolts and attaching-screw holes. Then bore the holes.

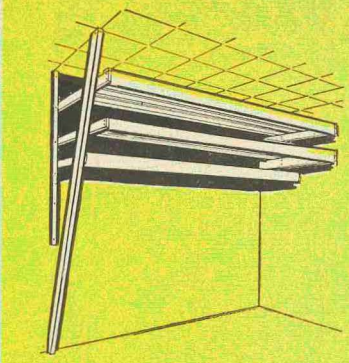
From 1⅝ x 2-in. stock, make the lathe-bed block one inch longer than the distance between the lathe-bed rails (Fig. 2C). Scribe a centerline around the block and mark the distance between the lathe-bed rails on the bottom of the block and body. Make the ¼-in. thick guide block just wide enough to slide between the bed rails. For a Shopsmith, make the guide block ¾-in. thick and bend the edges which contact the bed rails as in Fig. 2F.

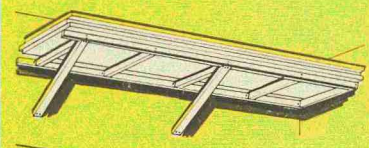
Using centerlines for alignment, clamp the body to lathe-bed block and drill two 5/32-in. pilot holes into the block; then fasten with #14 x 2½-in. *fh* screws. Center and assemble the guide block to underside of lathe-bed block with four #5 x ¾-in. *fh* screws. Then drill a 11/32-in. clamp bolt hole through center of lathe-bed and guide blocks (Fig. 2B).

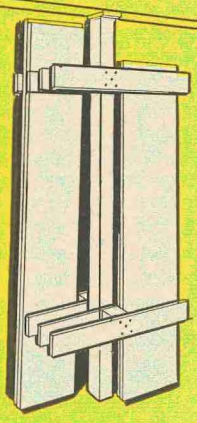
To hold center rest firmly on the lathe bed, make a clamp bar from ⅛-in. angle iron, ¾-in. longer than the distance between lathe-bed rails. Drill a 11/32-in. clamp bolt hole through center of angle iron. In use, place clamp bar lengthwise between lathe-bed rails (Fig. 2E), give it a ¼-turn, and tighten clamp bolt.

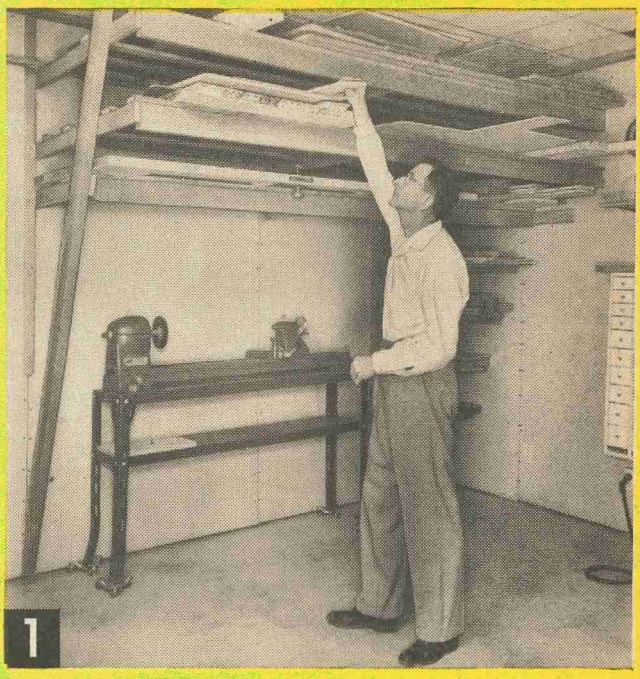
Make the three arms as in Fig. 2D. Fasten them to the body with 5/16 x 2-in. *rh* bolts. For arm guide pins, partially drive three #18 x 3-in. *fh* screws into the rest body. Cut off screw heads and projecting threads as in Fig. 2B. Lubricate arm jaws with paste wax.









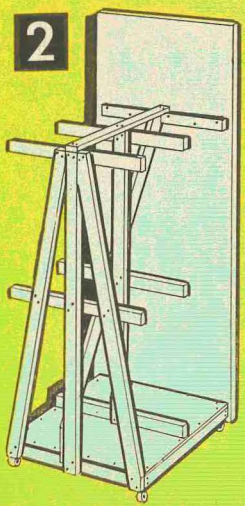


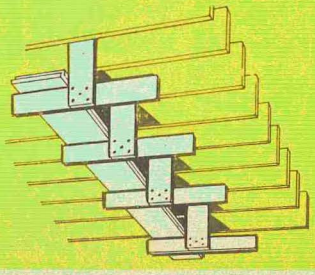
How A "Shop Pro" Stores His Lumber

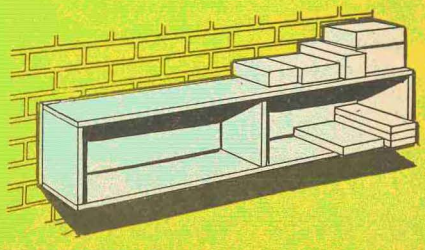
Home workshop problems call for experts whose training and experience have taught them the best solutions. That's why we asked Edwin Love—a long-time expert on workshop techniques—to dig deep into his lumber-handling lore, and come up with this special advice for you.

By EDWIN M. LOVE

THERE'S a knack to storing workshop boards and plywood. First, you must find storage room—within handy reach—in a workshop usually crowded with tools (and projects the wife is waiting for you to fix). Second, the lumber must be stored so that it is not dam-

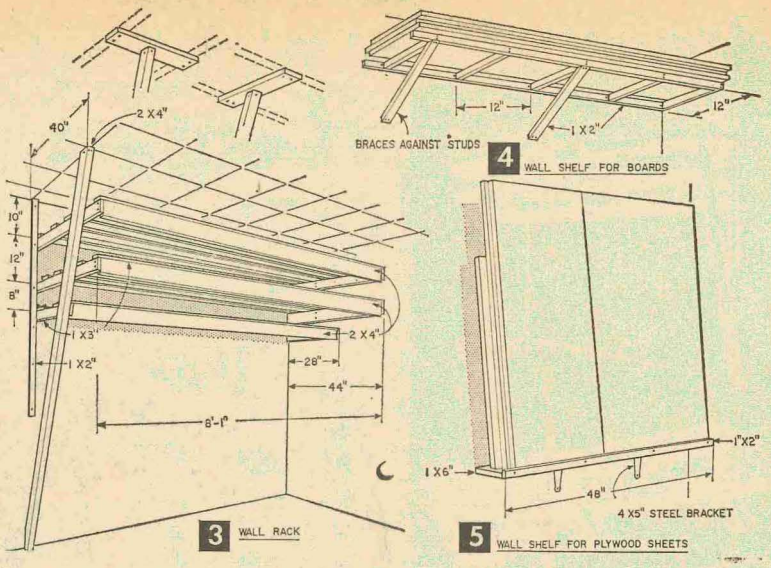






aged by moisture and heat.

The nine suggestions given here (Fig. 2) have worked well for me, and they should help you with the problem of finding space where none appears to be. As a general rule, it is best to store lumber horizontally, so that the weight of the boards helps to hold them flat. Vertical storage of the boards subjects lower and upper ends to differing climates, and some warping strain from weight, but limited space may make it necessary. Vertical racks are convenient.

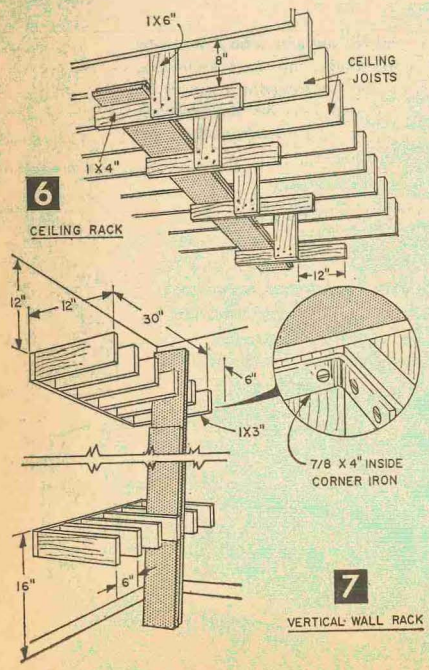


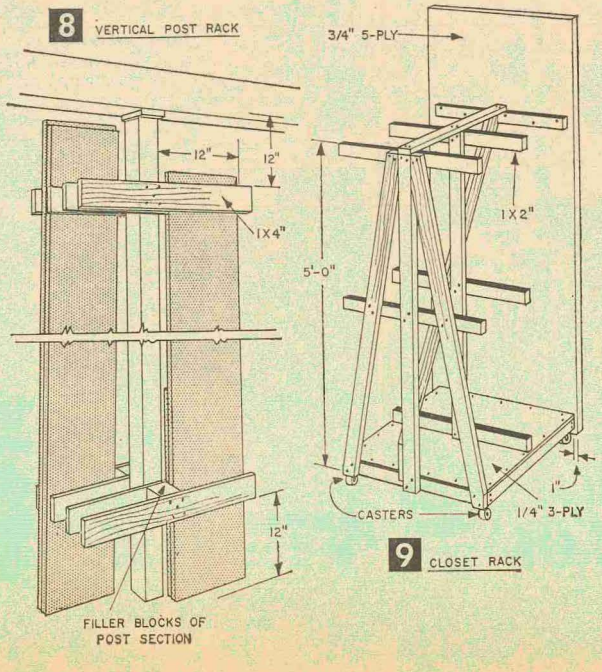
Boards should not be laid directly on a concrete floor, where seepage or condensation might upset the moisture balance of the wood. Nor should they be stored in the superheated air under a hot roof, which may cause checking. Fortunately, it is not hard to rack your lumber above the floor, and most home shops are not too hot and dry at the ceiling.

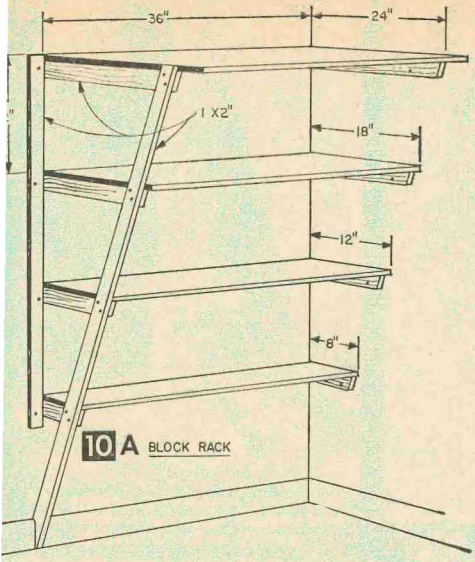
Lumber racks can usually be spiked directly to frame walls by driving nails into the studs. In masonry, either nail them into wood plugs driven into holes made in the mortar with a star drill, or use masonry anchors.

The rack shown in Figs. 1 and 3 affords handy flat storage, where materials can be slid in or out from the front. Being located above the height center of the wall, the shelves leave the wall free for a bench or a machine. To accommodate a full plywood sheet the inside length is a little more than 8 ft. You can nail the foot of the sloping support anywhere along the sole plate, but if the upper end cannot be spiked to a ceiling joist, use a cleat bridging two joists.

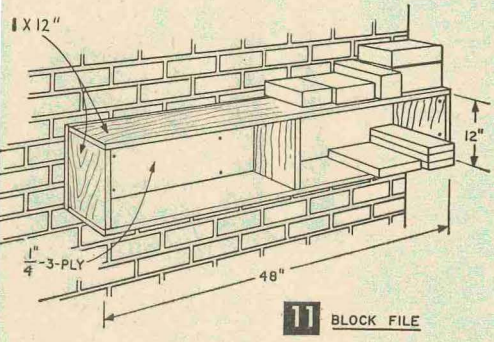
Nail up a vertical wall cleat to carry the shelf supports, or rest them on cleats span-







10 A BLOCK RACK



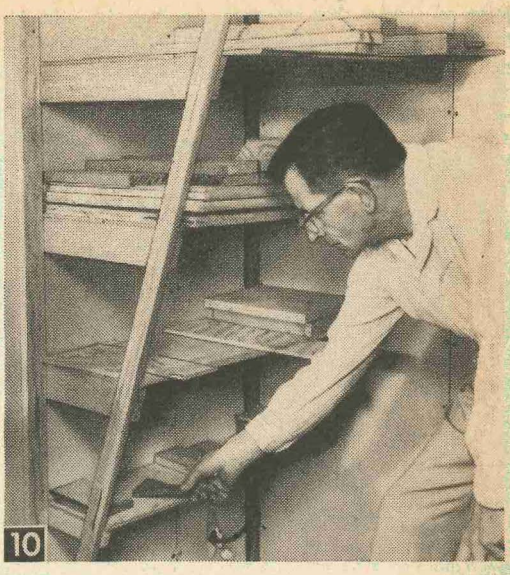
11 BLOCK FILE

ing the studs. Strip the shelves with 1 x 3-n. fir.

A single, ladder-like shelf (Fig. 4) built rom 1 x 2-in. strips mounted on a wall near ne ceiling is one of the most convenient of umber racks. As this space is likely to be ree, the shelf can be extended for some istance for storing long boards. Or it can e used sectionally, with boards of one width iled together.

For storage of half-sheets of plywood or maller, try a narrow-ledged shelf located on n upper half of a wall, as in Fig. 5. Steel rackets, having no braces, conserve space by llowing a machine to fit snugly under the helf. The nearly upright position of the ply-vood nullifies side stresses, helps the ply-vood to retain its flatness.

Where there's no wall space for a hori-ontal rack, try hanging a double-rack from ne ceiling joists, as in Fig. 6. Nail the hang-rs to the joist sides, and then the cross-pieces o the hangers, thus providing for boards to e laid on from both sides. On covered ceil-ngs, attach the hangers to the ceiling with ron inside corners. Avoid heavy loading.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Three-deck rack for short boards and blocks.

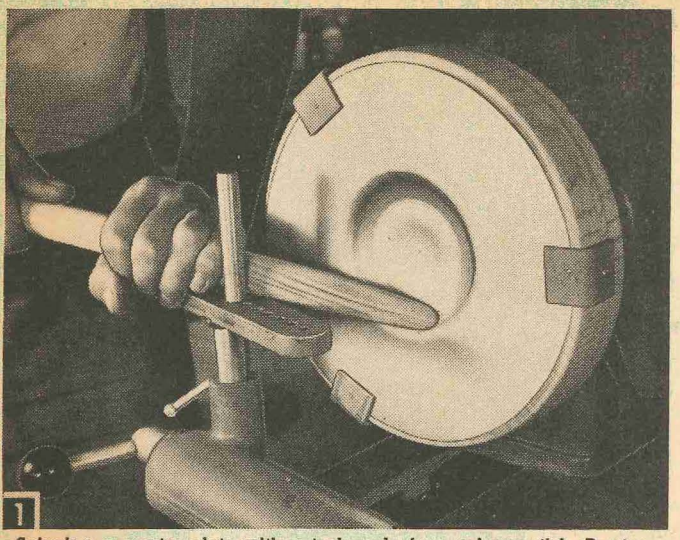
When horizontal racks are not possible, find a corner for vertical lumber storage as in Fig. 7. Two sets of spacers or fingers built of 1 x 3-in. stock support a few boards in each pocket; an added center set will take care of short boards. Iron inside corners hold the spacers rigidly, if placed near the upper edges and secured with stove bolts having washers and nuts sunk flush in counterbores. Attach the backs of the racks to the wall with lag screws or substantial masonry anchors.

If your shop has columns supporting a girder these may be converted into vertical storage racks as in Fig. 8, using spacer blocks cut from beams of the same size as the posts.

Basement shops occasionally have closets opening from them, and these offer space for vertical racks on wheels (Fig. 9). Build a base frame of 1 x 3-in. strips 2 in. narrower than the opening. Brace in both directions. Such a rack not only rolls out easily for access, but can be moved to the point of use. Attach plate casters with 1¼-in. wheels to corner blocks set under the platform.

But what about short boards and blocks? Tossed in a box, these become hard to sort. Why not have a short 3-decker rack, as in Fig. 10, which gives you a visible file system. Such a low corner rack is partially visible in Fig. 1. Range the pieces from small to large and according to thickness and width, with lengths appropriate to the shelves. Stack woods of a kind together, ends out. With this setup, loose blocks are easily stored.

Another idea for a small block file is shown in Fig. 11. This rack is made of 12-in. boards having a plywood back. It is attached to a wall with nails or anchor screws driven through the back. Adapt the length to your available space and locate it conveniently.



Spinning a pewter plate with a tool made from a broomstick. Pewter is mounted on a hollow-type wooden chuck that was previously turned to shape of plate desired. In place of a retaining ring, metal angles hold the blank in place. These should be bent at slightly less than 90° so that the leg of the angle will force the blank against the chuck and hold it firmly. The lack of a retaining ring will allow the rim of the disc or blank to lift. When this happens, tap it down with a rubber mallet. This type of chuck can be used to hold smaller discs for off-center spinning as in Fig. 9, which gives a certain amount of flexibility in project design.

Metal Spinning

How to make your own spinning tools; select metals; make and use your own spinning chucks; plus plans for spun-metal projects

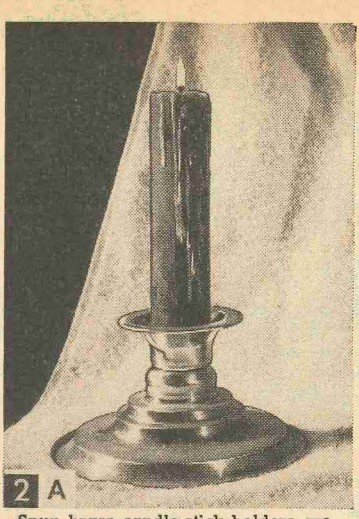
BY R. J. DeCRISTOFORO

METAL spinning in a lathe is the process of forming sheet metal into circular, three-dimensional shapes as pictured in Figs. 2A, B and C.

The process is almost as old as the lathe itself, and is used in industry today for custom made parts or short production runs of duplicate parts to avoid resorting to costly dies and expensive press equipment to manufacture the same item. The process is especially useful for making reproduction brass parts for the restoration of antique cars.

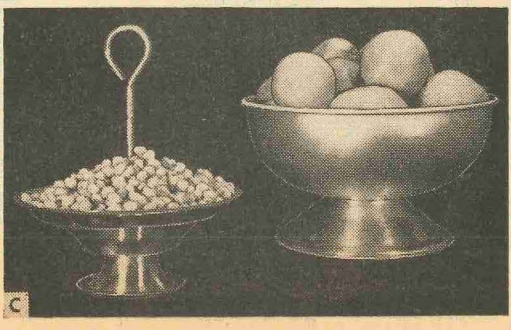
Although commercial spinners use lathes made especially for spinning, you can use a home-workshop size wood lathe for spinning metal objects as large as the lathe capacity. If you intend to go into metal spinning as a vocation or even part-time vocation, however, it would pay to invest in a lathe having a heavy-duty thrust bearing on the head-stock spindle shaft.

A variable speed arrangement on the lathe which will permit spindle speeds as low as 300

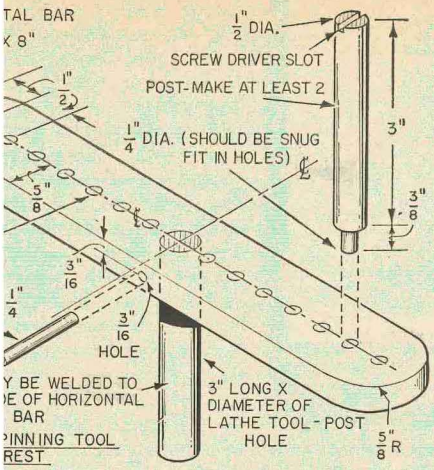


Spun brass candle-stick holders are ever-popular spinning projects and always welcome as gifts.

This modern-styled lamp base requires considerable metal spinning skill because of the deep cone shapes that must fit tightly on turned wooden center section.



Projects like this nut dish and fruit bowl are fairly simple to spin and find a ready market in gift and novelty shops.



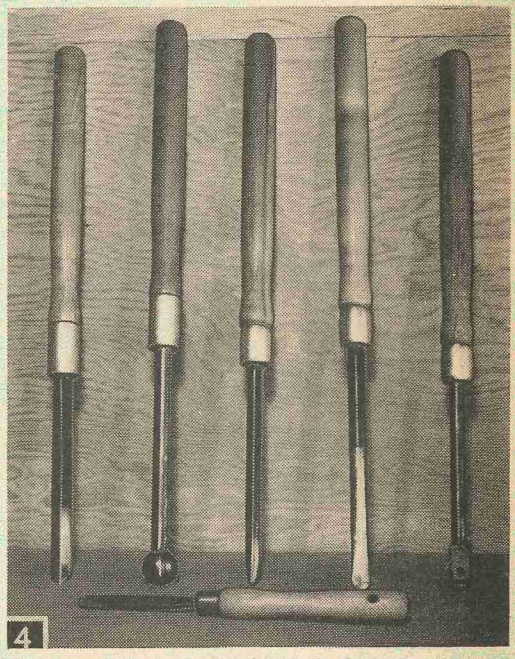
uld be helpful for the beginner. A reduc- spindle speed means a reduction in the gal force built up in the work piece. This n be a potent factor when you're spinning 12-in. dia. metal disc. The spinning tool ot only combat the natural resistance of erial (which wants to stay flat) but also ce which tends to keep the material at ngles to the chuck. As you progress you dually increase the spindle speed to 1000 ou won't ever find it necessary to go his speed. Even the highly skilled com- spinners who travel in the 2500-3000 *rpm* lo it merely to increase production, not

Rest. The first thing you'll need is a spe- inning rest" (Fig. 3) because the tool rest wood lathe cannot be used for spinning. sic design of this special rest is similar ne the lathe comes equipped with, except s tool rest is flat and has a series of holes ing posts or "fulcrum pins" against which ning tools may be braced as in Fig. 1 to the leverage necessary to spin the mate- r forms or chucks (Figs. 6 and 7).

he spinning-rest base from steel round a suitable diameter for the existing hole in the lathe tool-post. The base may be fastened to the horizontal bar with a metal pin, as in Fig. 3, or welded to the underside of the bar.

The fulcrum pins (Fig. 3) should fit tightly in the ¼-in. holes drilled in the bar. Make the horizontal bar from cold drawn steel and drill a series of ¼-in. holes in it as in Fig. 3. Many spinners recommend a loose fit here so the pins can be quickly moved from hole to hole—but nobody is rushing you and a snug fit will guard against the pins popping out or vibrating when you are spinning.

Although design of commercial spinning tools (Fig. 4) has been standardized to a few basic shapes, you'll find as you go along that you'll be making your own tools, basing their design



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Commercially made spinning tools are made of metal and have wooden handles. Compare large size of spinning tools with ordinary lathe-turning chisel shown in foreground.

on back side
rectly opposite
tool to guard
nkles and bow-
for trimming
etal discs. C,
tool for gen-
ng and laying
metal—for
out irregulari-
inkles and tru-
oulders, coves,
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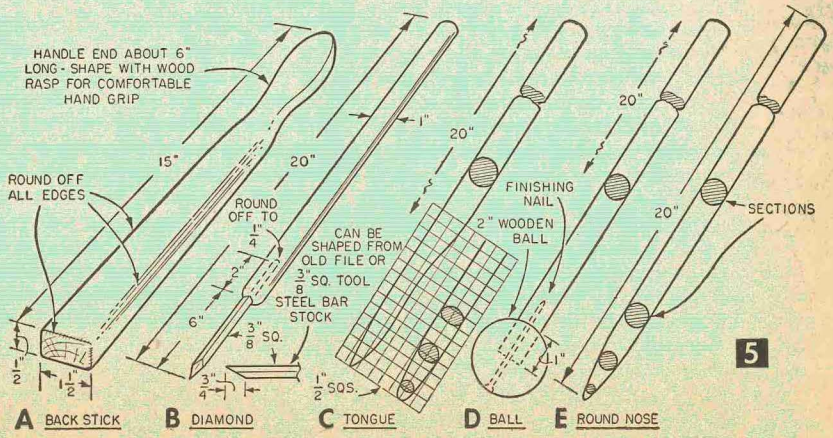

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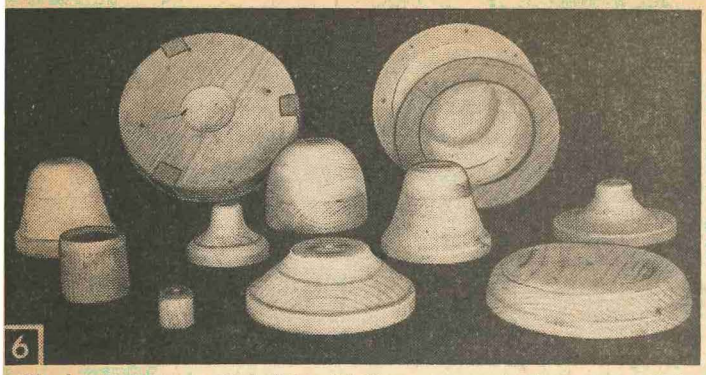
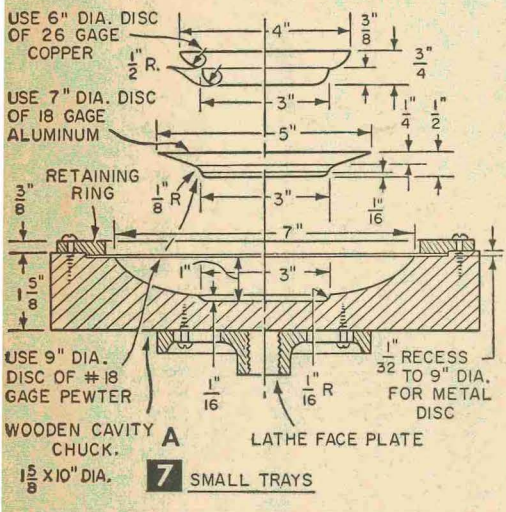


Wooden forms, over which flat metal discs are spun to shape, are called "chucks." The two large diameter chucks in the background are "hollow" chucks. Chucks in foreground are "external" chucks.



on the particular requirements of the work you are doing. Many of the home-made tools shown in Fig. 5 were made from lengths of broom stick. The ball end of tool D is a large wooden bead. The trimming tool was made from an old square file; the back stick was shaped up from a piece of ½" birch.

Since spinning tools are used by forcing the end of the tool against the turning metal blank, considerable friction results. That's why metal spinning tools are very hard and highly polished. When you make your own wooden ones be sure to use a tough, close-grained wood like hard maple. Sand the tools glass-smooth at the working end but don't attempt to seal them or apply any sort of finish. Examine them frequently in use, and if any roughness develops, sand smooth immediately.

The backstick (Fig. 5), is used to back up the metal directly opposite the point of the spinning tool. It does not have to be any special shape, but will be more comfortable to handle if one end is formed for a comfortable hand grip.

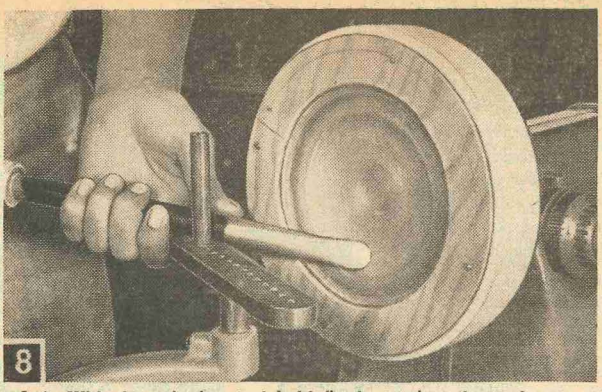
Spinning Chucks. The form over which the flat metal sheet is shaped (Fig. 6) is called a chuck. Each project, or each shape you want to spin, must have its chuck. Usually a wood w will stand up under a lo pressure (maple or birch used for the chuck, but has been used success when just one shell was quired. You do run the da of transferring the grain tern of the wood to the m during the spinning pro but selecting a clear, grai pine eliminates this. Sh it become damaged when s ning the first shell, tur down to a new shape and again.

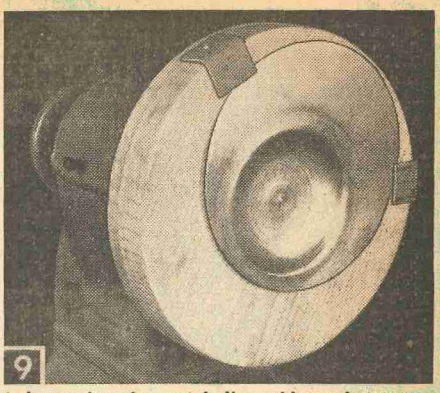
The easiest way to us chuck is to leave it on the original face plate to turn it. If the chuck must be removed f the face plate be sure to mark the chuck and face plate so chuck can be remounted in exa the same position used when the chuck turned. When the depth of the chuck per use longer screws than necessary when mo ing a block on the face plate. If the chuc maple, drill adequate lead holes for the scr if the chuck is pine, keep lead holes small, so screws will grip in the soft wood.

Metals for Spinning. Except for steel, all metals listed in Table A, can be spun successf by a beginner. The common metals used spinning can be divided into soft, medium hard. This would put steel in the "hard" c metals like monel and nickel in the "medi and the other metals listed in the chart as "s The beginner would do well to take the mate in the "soft" group and break these down 3 classes—putting zinc alloy and pewter "soft," aluminum into "medium" and copper brass into "hard." This is only a relative or ization to help you select suitable materials speedy spinning success. Copper, for exam is readily spun but work-hardens quickly requires frequent annealing. Pewter and alloy do not harden under the spinning tools you can complete almost any project witl having to remove the blank from the chuck annealing. Aluminum is an easy metal to but is more difficult to shape than the two arbitrarily placed in the "soft" category.

The best selection for experimental wor a zinc alloy which you can buy cheaply u the trade name of "ERAYDO." This is avail in most hardware and department stores, under the spinning tools, handles much like p ter. It does not require annealing unless design calls for a considerable amount of w ing; it yields readily to the pressure of the s ning tool which makes it unnecessary to re "bear down," and it can be soldered so handles, lips and feet are easily attached if project calls for them.

A step up would be to pewter which is expensive but spins out to beautiful and la





Left, With the spinning tool held firmly against the tool rest, start depressing the metal disc midway between center and rim by moving tool up and down. Right, Using metal retaining angles to hold the disc to be spun makes it possible to set the disc off-center, thereby increasing the design possibilities.

projects. Number 18 gage is a satisfactory stock for general use but avoid very heavy pressure on the spinning tool since the metal can be stretched easily and may tear.

Aluminum can be spun to a considerable depth so that even large bowls do not present great problems, but it conforms quickly to tool pressure with ever-present danger of creating an unwanted detail that is impossible to eliminate. Aluminum will also "thin-out" unless care is used. This creates a weak spot that will likely tear when work beyond that area is being spun.

Copper, of course, is very popular for spinning because it works up well and isn't too expensive. Try the lighter than 18 gage first and anneal as often as you have to. Don't go on working when you feel that the metal is resisting change more than usual under the pressure of the tool.

Brass is much like copper but work-hardens even more quickly, and, all things considered, is generally more difficult to work. Make a few projects in the other materials before trying one in brass.

Hollow-Chuck Spinning Techniques. This is one spinning technique which, while it doesn't encompass the exact procedure needed to turn out accomplished projects, it does give you the "feel" of the art and makes it relatively simple to spin out attractive little trays like those shown in Fig. 7, right off the bat. The metal blank is forced *into* a cavity turned in the chuck (Fig. 7A), rather than *over* the chuck.

Assume that the project is the tray shown in Fig. 7A. Mount a wooden block on the lathe face plate and turn to a 10-in. diameter. Then turn a cavity in the block to the dimension and shape of the tray and recess the face to 9 in. dia. and 1/32 in. deep to center the metal disc to be spun. Cut a 9 in. dia. disc from #18 gage pewter, place it in the recess on the chuck and fasten with a wooden retaining ring screwed to the chuck. The screws in the retaining ring should be positioned so they'll miss the metal disc or blank. Position the spinning tool rest so the point of the tool will be just slightly below the center line of the lathe spindle. Turn the lathe on and hold a candle against the metal as it is turning. This acts as a lubricant to reduce

TABLE A—MATERIALS DATA SHEET

MATERIAL	HOW TO ANNEAL	LUBRICANT	BEST THICKNESS	REMARKS
COPPER	heat until iridescent dull red—quench in cold water	soft soap tallow candle	22-26 gauge	anneal before working and frequently during spinning—if metal oxidizes during annealing, dip in 5% solution of sulphuric acid.
BRASS	coat w/lubricating oil and heat until oil burns off—dip in cold water	soft soap candle	22-26 gauge	treat similarly to copper, but since it work-hardens faster, anneal even more frequently.
PEWTER	not required	candle	18 gauge	sometimes called "Brittania" metal—easily worked but take care not to over-stretch or it will break—form slowly with intent to maintain original thickness.
ALUMINUM	generally not req., but if necessary heat enough to char white pine	heavy oil tallow candle	16-22 gauge	easily spun but lighter gauges tear quickly—beginner can try spinning simple shapes from sheet of "Do-it-yourself" aluminum.
ZINC ALLOY	generally not req., but if necessary hold in boiling water and spin hot	candle	.024-.016	excellent practice material—spinning properties quite similar to pewter—can be bought in sheet form from h'dware and dept. stores under trade name of "ERAYDO."
STEEL	must be kept well annealed—heat to bright cherry red, cool slowly in air	laundry soap	24-26 gauge	toughest to work—must be kept soft by frequent annealing—use bronze spinning tools—not favorable material for homecraftsmen.

the amount of friction created by contact between the tool end and metal. Then position the spinning tool using the tongue shape as in Fig. 8. Start with the tool midway between the rim and center of the metal disc and stroke gently towards the center; apply just enough pressure so you can see the metal begin to sink. Now start at the center and stroke towards the rim.

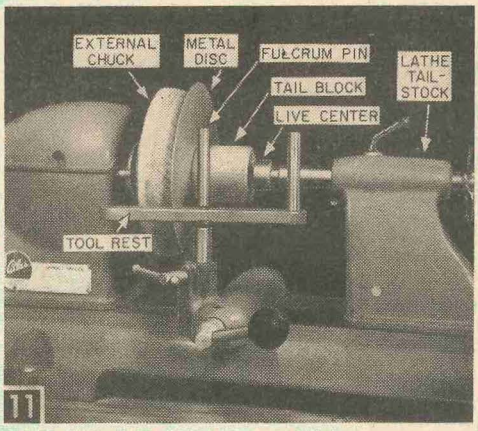
Work slowly, stroke gently from rim to center and from center to rim, to maintain equal metal thickness. When the blank has a gentle slope from rim to center, work from the center out getting the metal to conform *gradually* to the actual shape of the cavity. Be careful at the contours; work backwards and forwards from the base up, and then down again. If you maintain a uniform thicknesss of the metal, you won't tear it in areas where the contour is most extreme.

Finishing. Any of the metals called for on the spinning projects to follow can be given a luster by first removing the lubricant with lacquer thinner and then polishing with fine steel wool with shell still mounted over the chuck. Small scratches can be smoothed with a burnishing tool lubricated with grease. Heavy scratches require emery cloth and steel wool. Any of the common buffing compounds will add luster.

The polished finish can be sprayed with clear lacquer or with the new hammertone lacquers. For a novelty finish, dust on colored bronzing powders while the clear lacquer is wet. Give a second coat of lacquer to cover the powders. For a pebbled finish, ball peen metal lightly while the project is still on the chuck.

The fruit bowl, lamp base, nut dish and candlestick holder are typical of spun metal projects you can produce on your woodturning lathe.

External-chuck Spinning. This method of spinning will enable you to turn out the accomplished projects, shown in Fig. 10. The big difference between internal and external spinning is that in the former the metal is spun *into* a shaped cavity while in the latter the metal is spun *over* a shaped form. Fig 11 shows the set-up for external spinning. The wooden external chuck, which has previously been turned to the desired shape of the object to be spun, is mounted on the lathe face plate. The metal disc or blank to be spun is centered on the chuck and securely held against it by the tail block, which in turn is pressed against the blank by the lathe tailstock. Since the tail block must turn with the chuck and blank, it must be mounted on a *live* tailstock center. Trying to use a dead center, no matter how well lubricated, just won't work because friction would soon enlarge the center hole and render the tail block useless. Furthermore, such practice would be dangerous because a loose tail block would permit the blank to fly out.

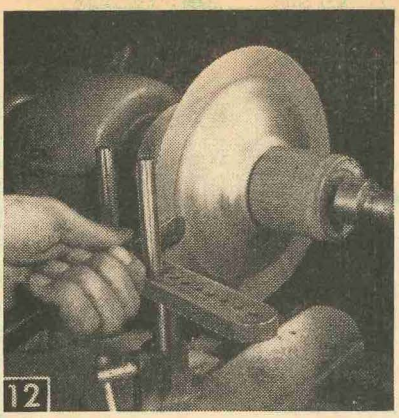


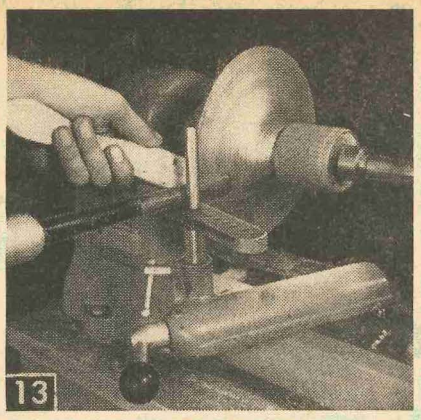
Correct setup of parts for spinning a metal disc over an external chuck. A ball bearing live center must be used to take the thrust load of holding the metal disc between chuck and tail block.

The size of a metal spinning disc needed to cover a chuck can't be determined by any set formula. It's best to be generous with the size of the disc when starting, then, when enough of it has been spun down to allow a fairly accurate estimate, the excess can be trimmed off. If more than one shell is to be spun over the same chuck, then the initial blank can be used to determine the size of the succeeding ones.

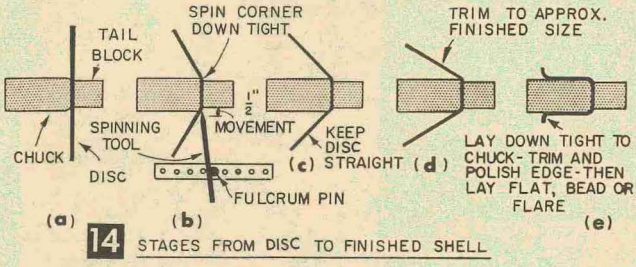
Insert the disc between chuck and tail block centering it as accurately as possible and then tighten up the tailstock just enough to keep the disc in place when you turn the motor on. *Be sure to stand to one side.* When the lathe is running, hold a length of hardwood lightly against the rim of the disc. Now it is safe to loosen the tailstock just enough to permit centering the disc with the stick. When it is turning smoothly against the stick, tighten up the tailstock—but just enough to do the job! Excessive pressure here could do damage to lathe bearings.

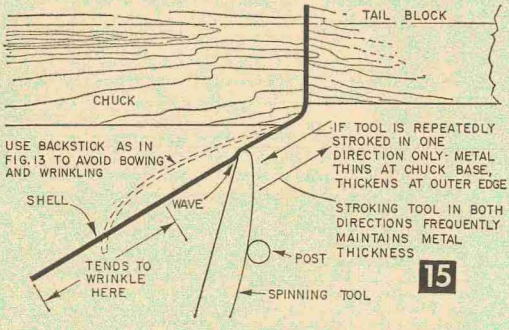
The next step is to lubricate the disc. Although each material has a "best" lubricant (see Table A on page 89), we found that an ordinary candle worked out satisfactorily as a general lubricant.





Left, A small "wave" of metal is formed just ahead of the spinning tool and is carried from base to rim of disc. Right, The back stick is placed to oppose tool pressure. Move it along with the point of the tool. Mount a second fulcrum pin to brace the backstick if needed.





Apply by holding the candle against the rotating disc before you start spinning, and as frequently thereafter as you feel necessary. Applying too much won't hurt, although it may be messy; but too little could do damage to the material. The initial fulcrum pin location should be just to the right of the disc, with the tool rest placed so the edge of the disc just clears it (Fig. 11).

Place the spinning tool in position with its point almost touching the tail block, and braced against the fulcrum pin for leverage (Fig. 14B). In this position, exert a slight pressure against the disc as you carry the point of the tool towards you about ½ in. and then quickly back again to the starting point. The idea here is to coax the disc to the shape of the chuck base corner, close to the tail block, as quickly as possible. This builds up resistance at a potentially weak point —where the tail block is pressing the metal against the base of the chuck. If, for example, you immediately carried the tool point right out to the edge of the disc in an effort to spin the whole shell quickly, it would chatter and weaken the metal enough to break it at the forward edge of the tail block.

With the first half inch or so of the project spun down, start the point of the tool near the base and carry it out toward the very edge of the disc as in Fig. 19. Use very little pressure because it's here where the spinner's enemy, called "wrinkles," shows up. If you apply little pressure and carry the tool out slowly to the edge of the disc, it will assume a conical shape (Fig. 14C and D). Many repetitions of this basic procedure enables you to spin a flat sheet to the chuck's shape.

What happens to a metal disc during the spinning operation is shown in Fig. 15. A "wave" of metal (size of wave depends on tool pressure) moves in front of the tool's point. The idea is to carry this wave out to the edge of the disc without causing wrinkles to appear and without making the disc "bow" outward. The bowing is not so bad as the wrinkles; in fact, on some projects, it can be used to advantage. The wrinkles sneak up on you. As soon as you hear a sound, no matter how slight, that's like the noise made by running a stick across a picket fence, you'll know the metal is wrinkling. When this happens, anneal it immediately. If annealing is not required for the metal you are using, try to work out the wrinkles with tongue tool and backstick (Fig. 13). Hold the backstick against the back of the disc directly opposite the point of the spinning tool, and move it along with the tool. Since pressure is now exerted on both sides of the disc, wrinkles will not form so easily. However, too much pressure on the tool point against the backstick can thin the disc material, so again, work slowly and do not use excessive pressure.

Avoid stroking the spinning tool in one direction only. Every other stroke, or at least every third stroke, should be from the rim toward the center to avoid thinning the material to the point where it will break at the corners.

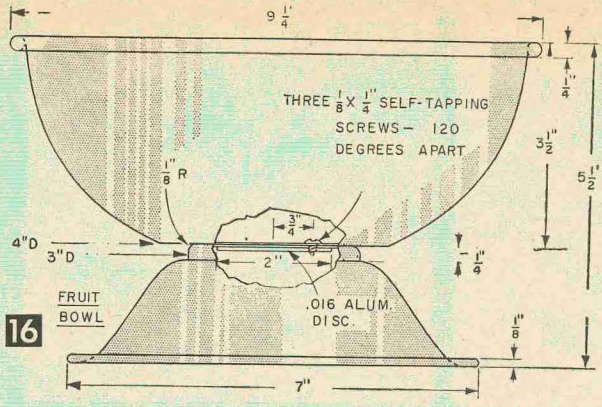
Examine the edge of the disc frequently, especially when spinning copper or brass, for here the metal will thin and small breaks will occur.

You can use a diamond cutting tool to shave the edge and remove any jaggedness. It's a good idea to polish this edge with steel wool too. There is no set rule for frequency of this operation. Do it as often as you feel the edge requires it. Do it for the last time just before the final ½ in. of metal is going to be spun down.

When the edge of the shell is to be beaded (turned back on itself in a nice rolled edge), it should first be polished smooth with steel wool. Be sure the flange, or amount of material that will be turned, stands away from the chuck. One commercial spinning tool employs a small wheel which looks like a pulley to form the bead. This is held at a slight angle to the flange and slowly straightened as the bead begins to form.

Much the same thing can be accomplished by using the tongue tool and a backstick. In fact, this is typical of times when improvisation does more for your work than a cabinet full of tools.

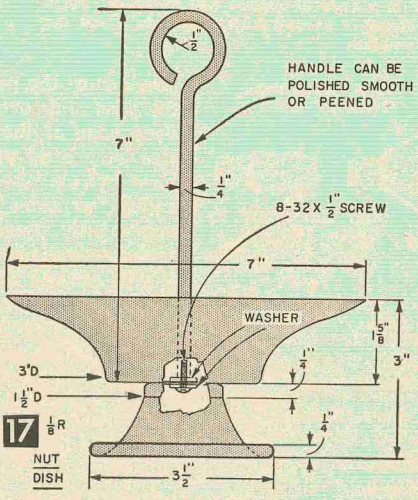
Spinning in Air. This procedure can be used to elaborate a shell being spun over a simple chuck. In such a case, the base of the shell should be spun down tight to a bell-shaped chuck. Then the point of the tongue tool is pivoted in a short radius. This causes the shell to bow in a limited area which makes it possible to raise a shoulder which does not contact the chuck at all. Be sure to work the tool point back and forth to guard against over-stretching the metal in one direction. This method can be successful in creating different designs over one basic chuck. It would not be good however, for any kind of production run.



16

MATERIALS LIST—FRUIT BOWL

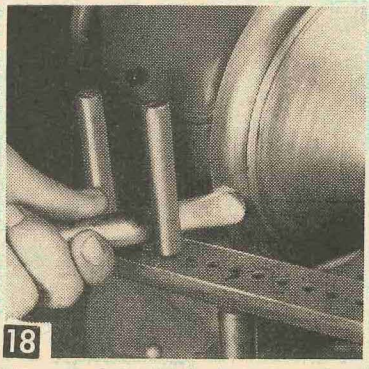
Size and Description
18 ga. x 14" dia. disc of aluminum
18 ga. x 10" dia. disc of aluminum
16 ga. x 2" dia. disc. of aluminum
1/8 x 1/4" long self-tapping sheet metal screws



17

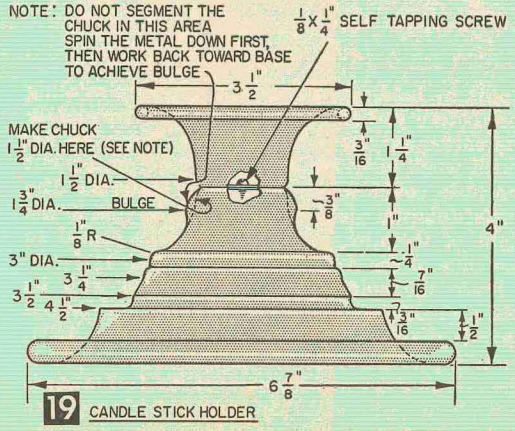
MATERIALS LIST—NUT DISH

No. pcs.	Size and Description
1 pc	18 ga. x 10" dia. pewter
1 pc	18 ga. x 6" dia. disc of pewter
1 pc	1/4" dia. aluminum rod, 10" long
2	1/2" aluminum washers
1	8-32 x 1/2" long rh machine screw



18

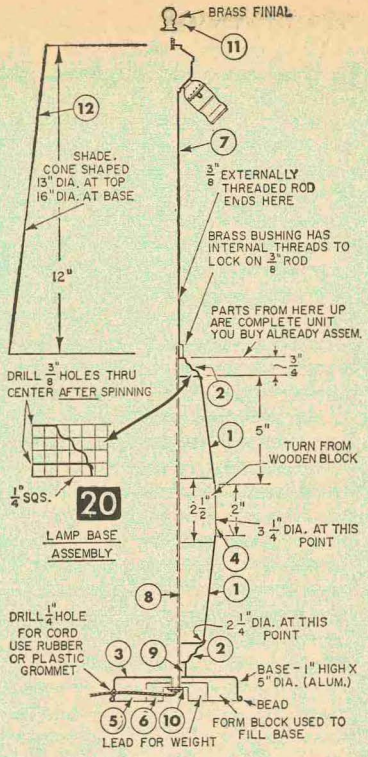
If a rounded edge is desired on the nut dish, you can accomplish it without change in chuck design merely by forming it "in air." After the dish has been completely spun down to the chuck, "rotate" the tongue tool slightly on the tool rest as its end is pressed against the rim of the metal. This will cause the metal edge to form over in what might be described as a half-head.

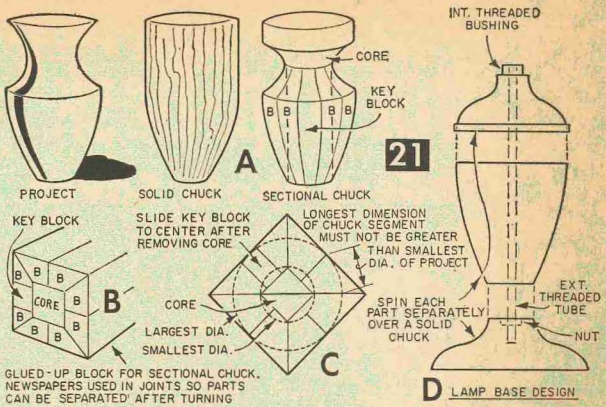


19 CANDLE STICK HOLDER

MATERIALS LIST—CANDLE STICK HOLDER

No. pcs.	Size and description
1 pc	26 ga. x 10" dia. disc of copper
1 pc	26 ga. x 4 1/2" dia. disc of copper
1	1/8 x 1/4" long self-tapping sheet metal screw





MATERIALS LIST—LAMP BASE ASSEMBLY, FIG. 20

Part	No. pcs.	Size	Material
1	2	15" dia.	18 ga. aluminum
2	2	3½" dia.	22 ga. brass
3	1	8" dia.	18 ga. aluminum
4	1	2½ x 4 x 4"	birch
5	1	use form block over which base was spun	
6	1	lead (or piece of steel if available) to weight base	
7	1	upper lamp assembly (electrical or hardware store)	
8	1	⅜" externally threaded tube, about 18" long	
9	2	¾" brass bushing with ⅜" internally threaded hole	
10	1	⅜" brass nut	
11	1	brass finial	
12	1	suitable shade with approximate dimensions shown in drawing	
	10 ft	lamp cord and outlet plug	

A project which requires a center hole makes it possible to attach the blank directly to the chuck. Here, a backstick should be used right from the beginning to ease the tool pressure which would create a strain at the screw and cause the metal to break there. It's a good idea, when first trying this method, to use a tail block also, or to place a large washer or thin wooden disc under the screw head.

Sectional Chucks. The toughest projects to spin are those which have an "undercut" area (Fig. 21). One answer to the problem is to use two chucks; first a solid one (Fig. 21A) and then a sectional one.

Make the solid chuck to the base shape of the project, ending just where the neck begins to narrow. Turn the second chuck from glued-up blocks to the full shape of the project (Fig. 21B). Before attempting to shape the segments, make a plan view (Fig. 21C) to indicate the largest and smallest diameters of the project so that the widest dimension of any segment can be removed through the smallest diameter of the project after the core of the form block has been withdrawn. The key block is the block which must be removed first (following the core). When the parts for the segmented form block have been made, glue them together, using ordinary newspaper between the joints. After turning, break the segments apart at the newspaper joints. The shell, spun over the solid chuck, will hold the segments of the sectional chuck together. Start the spinning over the sectional chuck at the point where the neck of the vase begins to narrow to further secure the segments. After the shell is spun tightly around the chuck, remove the center core, key block, and segments.

Another method of spinning narrow-necked objects involves breaking up the design of the project into separate parts, each of which is spun to shape over its own solid chuck. For example, in the lamp base design (Fig. 21D), the parts would be spun and then held together by a threaded tube extending through all the pieces.

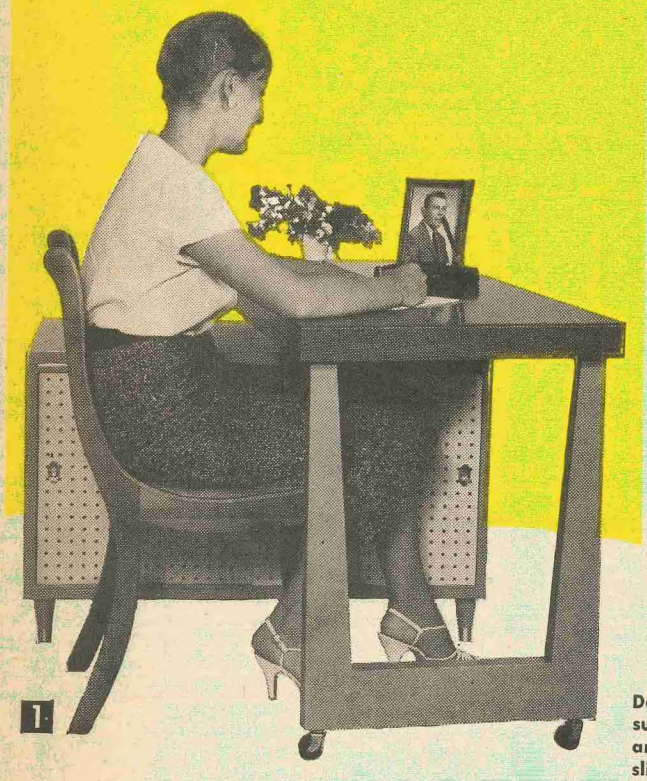
Nut Tray and Fruit Bowl. These two projects, shown in Figs. 11 and 2C, are fairly simple and the part you may have trouble with (providing you've done some preliminary work) is the fruit bowl because of its size. Make external chucks from Figs. 16 and 17.

Candle Stick Holder. The socket of this candle stick holder (Fig. 19) is dimensioned for the large 1½ in. dia. Christmas candles (Fig. 2A), so be sure to alter its size if you intend to use it for the slender tapered candles. Two exterior chucks are required.

The Lamp Base Assembly (Figs. 10 and 2B) is a more advanced spinning project. Dimensions for chucks, and details for assembly of parts are shown in Fig. 20. Two or three "stage" chucks would be a good idea for parts 1. These would be a starting chuck and several cone-shaped intermediate chucks so the shell can be spun down to final shape in stages. Turn part 4 from a 4 x 4-in. block of birch after making parts 1 to assure a good fit at assembly.

Pivot-Top Desk

a Modern Space Saver



1

By HAROLD HUDSPETH

THREE forms of hardboard on simple framing combine to make up this attractive and economical pivot-top desk which can extend in any direction from its cabinet base as in Fig. 1, expand its overall length (Fig. 2) or swing around it completely when minimum space is desired as in Fig. 3.

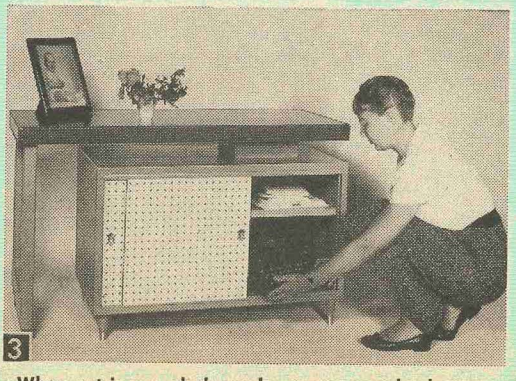
The design makes lavish use of ¼-in. tempered hardboard, yet with economy in mind. You can cut all the pieces from one 4 x 8-ft. sheet if you follow the pattern outlined in Fig. 4. Small stock pieces given in the Materials List are ample for the perforated hardboard sliding doors and storage compartment sidewalls, as well as for the 3/16-in. hardboard which is adaptable for a simplified method of drawer construction.

Be sure to order the 2⅝ and 1⅝-in. lumber to length specified in the Materials List—or double it—for more economical cutting. And plan to rip all wider pieces of lumber from a 7½-ft. length of 1 x 12-in. (nominal size) pine. The little

Desk top offers a 48-in. wide work surface and swings to any position around cabinet. In this setting, slightly more than a right angle, girl can slide left-hand door and pull out either drawer without leaving or moving her chair.

2

Extended to full 62-in. length, the pivot-top desk is an appropriate setting for decorative displays and becomes an effective room divider.



3

When not in use, desk can be swung completely over cabinet to save space, yet still serve as attractive furniture piece. Note adequate storage.

scrap remaining will come in handy if you spoil one of the narrower pieces.

Base Cabinet Assembly. Make frames for the cabinet top, base, center divider and both ends according to dimensions given in Fig. 5A, using 2½-in.-wide stock for bottom front rail, top and bottom center crosspieces and the three front posts, and 1⅝-in. boards for all other pieces. Square each joint, clamp and secure with corrugated fasteners.

Attach end frames to side edges of bottom frame with 8d finishing nails. To fasten center divider in position, turn over assembly and nail through bottom of crosspiece. Right the assembly again, place top frame over divider frame, square with end pieces and nail. Plumb the divider and nail top to it. Locate drawer guides as in Fig. 5B and tack in position temporarily, ends flush with outside edge of rear posts.

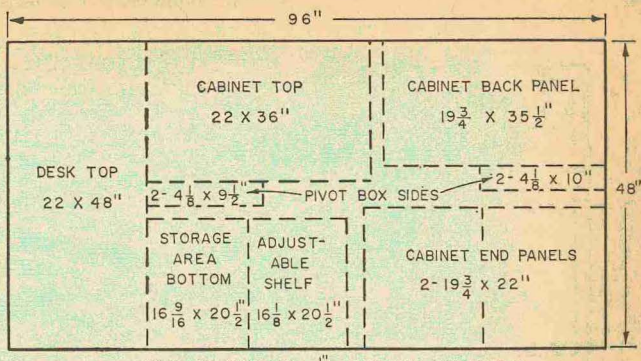
To install legs, drill ¼-in. dia. holes through the base frame 2 in. from each edge at corners, countersink and drive T-nuts in place as in Fig. 5C. Screw legs up tight. If you wish to turn the legs in your lathe, follow dimensions in Fig. 5C. If you buy legs with brackets for undercabinet attachment instead of hanger bolts, be sure that overall length of bracket and leg is 4 in.

Applying the Hardboard. Saw a 22 1/16 x 48-in. piece off an end of the 4 x 8-ft. tempered hardboard for the desk top and put it aside. Now turn back of cabinet up, place one end of the remaining sheet on the back in position shown in Fig. 4, mark off two remaining sides and saw off piece to cover framing. Glue and brad piece in place, smooth side out. Smooth any rough edges flush to frame.

It's best to place hardboard against the work, marking and cutting each piece as you go, in the same position shown for it in Fig. 4. With a different layout, you may need to buy more hardboard to complete your cutouts. Marking from the work instead of trusting to the exact sizes in the plan will give a better fit if there is any deviation in the framing.

Mark pieces to cover end frames plus edge of back panel, cut and install as above. Sand edges flush. Turn cabinet up again, mark off, cut and install top, and smooth edges. Cut panel for storage area bottom, aligning front with outside edge of center post as in Fig. 5A. Glue and fasten with brads.

To make the pivot box (Fig. 5D), cut two 9½ x 9½-in. blocks, clamp together to centerbore a ½-in. hole. Out of the remaining tempered hardboard pieces, cut sides to dimensions given in Fig. 5D, then assemble box with glue and brads. Glue box to cabinet top over storage area, 6 in. from front, side and



4 GUIDE TO MAKE ALL ¼" TEMPERED HARDBOARD CUTS FROM ONE 4X8' SHEET

MATERIALS LIST—PIVOT-TOP DESK

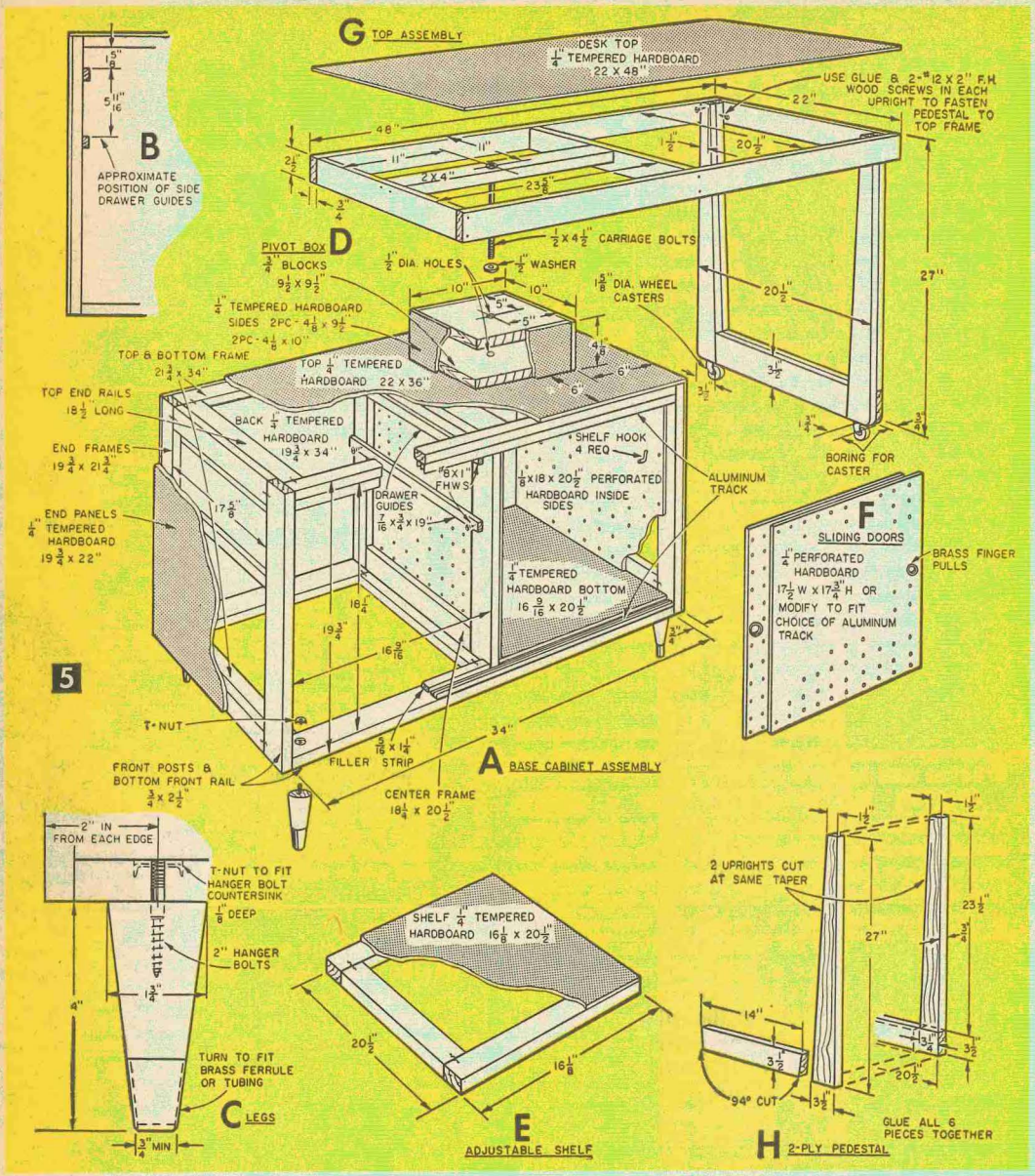
No. Req.	Size and Description
1 pc	¾ x 11½" x 7½' (nominal 1 x 12" stock) pine (rip out drawer fronts, pivot box top and bottom, 6 pedestal pieces)
5 pcs	¾ x 2⅝" x 6' (nominal 1 x 3") pine (cabinet, desk top, shelf framing)
6 pcs	¾ x 1⅝" x 6' (nominal 1 x 2") pine (cabinet desk top framing)
1 pc	2 x 4 x 24" (for desk top frame)
1 pc	7/16 x ¾ x 78" strip (for drawer guides)
1 pc	5/16 x 1¼ x 16 9/16" strip (for filler strip)
1 pc	¼" x 4 x 8' tempered hardboard (Masonite) (see Fig. 4)
1 pc	3/16 x 4 x 5' hardboard (Presdwood) (for drawer assembly)
1 pc	¼ x 18 x 36" perforated hardboard (Peg-Board) (for doors)
1 pc	⅛ x 24 x 36" perforated hardboard (for compartment)
1 pc	3', 2-channel shallow aluminum track for ¼" doors (Reynolds)
1 pc	3', 2-channel deep aluminum track for ¼" doors (Reynolds)
4	4" tapered legs with hanger bolts and T-nuts or brackets (about $3.50 set at many lumber dealers, hardware stores)
2	1⅝"-dia. wheel casters (ball-bearing type)
3	brass knobs (drawers)
2	brass flush finger pulls (doors)
4	shelf hooks (perforated hardboard)
1	½ x 4½" carriage bolt with 2 washers, lock washer, nut
4	#12 x 2" *fh* screws (pedestal)
8	#8 x 1" *fh* screws (drawer guides)
misc	corrugated fasteners, 8d finishing nails, ¾" and ⅜" brads, wood glue or contact cement, putty, paint or lacquer

rear edges of the top. Brad from underneath.

Divide the ⅛-in. perforated hardboard sheet into 18 x 20½-in. panels with holes in alignment, then glue and brad to each side of compartment as in Fig. 5A. Make the adjustable shelf as shown in Fig. 5E and place on shelf hooks installed in the perforated liners. If too tight, sand shelf side edges slightly for a snug fit.

Install the deep two-channel aluminum track to underside of top frame and the shallow track on bottom frame, placing both pieces against edge of the center post as in Fig. 5A. Glue and brad filler strip to bottom frame against inside of track in drawer section of cabinet. Cut door panels from ¼-in. perforated hardboard to size given in Fig. 5F so that hole patterns align and edge margins are similar. Install brass door pulls. Insert a panel in each top channel and drop into place in lower track.

Desk Top Assembly. Cut pieces for the top frame out of 2⅝-in. stock to sizes given in Fig. 5G, square ends and secure with two 8d finishing nails at each joint. Nail in a 2 x 4



crosspiece in that part of the frame intended to go over the pivot box, drill a ½-in. dia. hole through exact center of crosspiece and countersink for head of a carriage bolt, as in Fig. 5G.

To make the pedestal, rip out of wide stock a pair of 27-in. legs and another pair 23½ in. long, tapering the widths to dimensions given in Fig. 5H. Rip a 3½-in. wide piece 20½ in. long and another 14 in. long, angling the latter cuts 94° as in Fig. 5H. Glue the six pieces as shown in Fig. 5G and H and sand edges flush. Drill holes to fit casters in bottom of the base, centered 1¾ in. from each end and install the casters.

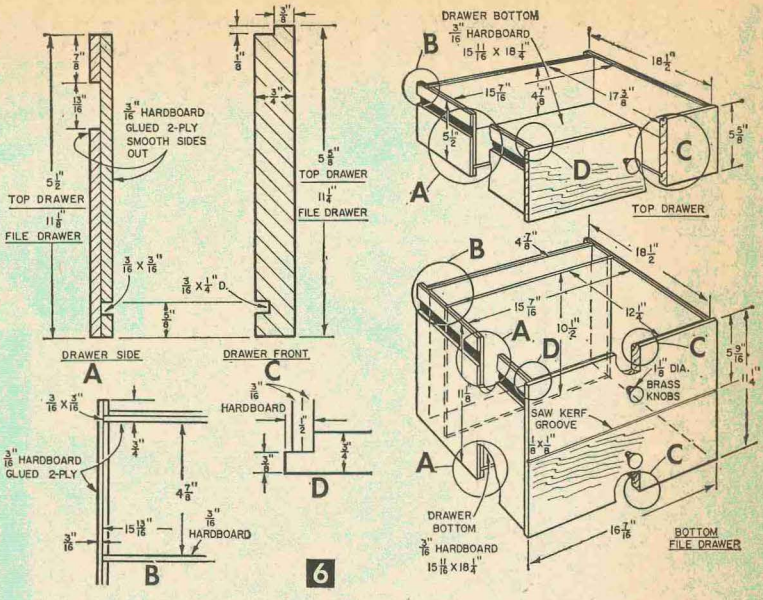
Now you can attach the pedestal to the top frame. Place leg ends against inside corners flush with top as in Fig. 5G, and fasten with #12 x 2-in. *fh* (flathead) screws, one into each adjoining rail.

Insert a ½ x 4½-in. carriage bolt through the frame's 2 x 4 crosspiece and add a ⅛-in. thick washer for a spacer as in Fig. 5D and G. Attach top frame to cabinet by passing bolt through pivot box and cabinet top, slip on a washer and lock-washer, then tighten with a nut. Glue and brad previously cut tempered hardboard panel, smooth side up, to top of

frame. Carefully sand any overhang flush to frame.

Drawer Construction. Except for the fronts, all drawer parts are 3/16-in. hardboard used two-ply for sides and back, single-ply for bottoms and file drawer partition.

Cut two pieces of the thin hardboard for each side and back of each drawer to dimensions in Fig. 6. Note that one ply of back is 3/8 in. longer than the other. Put matching pieces together, smooth faces out, glue and nail with 3/8-in. brads at a slight angle so points will not break through the two-ply. Clamp until dry. Cut single-ply drawer bottoms and the partition out of the thin hardboard sheet to sizes in Fig. 6. Cut the fronts out of wide pine stock to sizes shown.



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Mortise side pieces for drawer guides and bottom panel as in A-A of Fig. 6, for back panel as in B-B and for file drawer partition as in B-B. Rabbet the top and mortise near the bottom of each front panel as in C-C, then mortise side edges as in D-D. For decorative effect, saw a kerf across the larger drawer front as in Fig. 6.

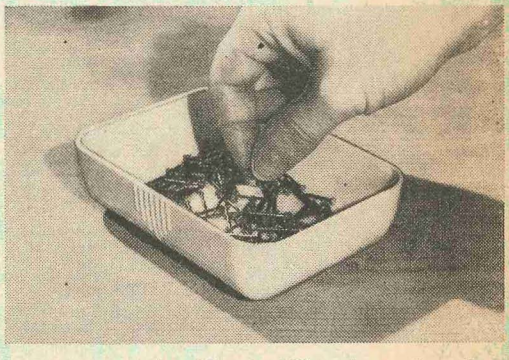
If you prefer, you can make all these mortises and rabbets with straight cuts through the single-ply hardboard, but this involves extremely accurate measurement and cutting to assure that each piece will fall in place just right for gluing.

To assemble, glue all pieces well at joints, then apply back to a side, slip drawer bottom in grooves, attach other side and finally, the front panel. For added strength, brad sides to front panel at rabbets and, from underneath, brad through panel and drawer bottom. Slightly bevel side edges of partition and slide it into place in file drawer.

Place completed drawers in cabinet and adjust drawer guide position. Screw guides in place and install knobs.

Set all exposed nail heads, putty the holes, sand surfaces smooth and your pivot-top desk is ready for a wide selection of finishes. We chose a dramatic three-color treatment; staining the desk frame to blend with the hardboard and then coating the whole top with lacquer; applying a semi-gloss, medium-grey enamel to cabinet and pedestal and, for contrast, touching up the drawers and doors in a flat off-white.

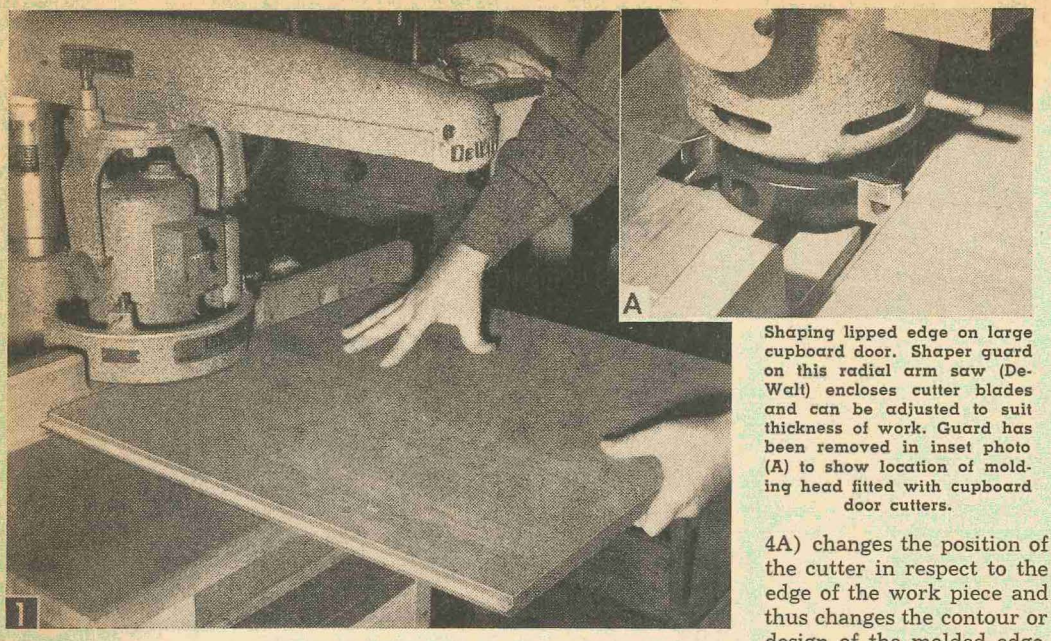
Small Parts Container



• If you work with small brads, tacks, glazer's points, machine screws and the like, keep a plastic soap dish handy to dump them into for the job. Such a dish picks up easily for moving around on the job, but, more important, the rounded inside corners let you pick up even the last screw without "digging" for it.—F. A. J.

Glue Dispenser

• A plastic mustard dispenser filled with glue will measure out even a single drop of the sticky stuff and keep your work neater and mess-free. A nail stuck into the nozzle tip will keep it closed and dirt-free when glue is not in use.—F. A. J.



Shaping lipped edge on large cupboard door. Shaper guard on this radial arm saw (DeWalt) encloses cutter blades and can be adjusted to suit thickness of work. Guard has been removed in inset photo (A) to show location of molding head fitted with cupboard door cutters.

Molding and Shaping Large Work

How to shape decorative edges on large unwieldy work pieces; making fixtures for edge molding circular and segment-shaped work and large cove cutting with molding-head cutter

By MILT EVANS

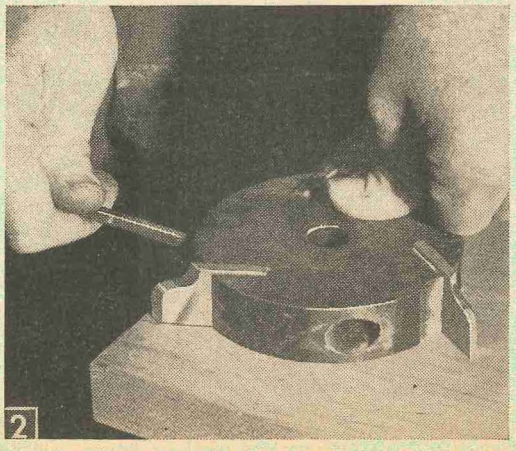
ACCURATELY feeding and guiding a large and wide piece of stock or a long and narrow board when shaping the edges is a lot easier if the stock can be handled in the horizontal position as in Fig. 1 rather than in the vertical position as in Fig. 5.

The large flat work table of the radial-arm saw and the fact that the arbor spindle with molding-head cutter can be locked in the vertical position makes this the ideal tool for these large unwieldy jobs. Then too, no specially-made, rip fence fixture to hold the work at right angles to the cutter as in Fig. 5 is needed.

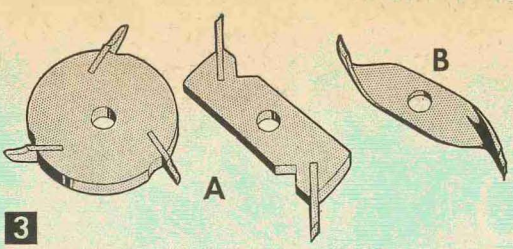
Two and three-knife slotted molding heads (Fig. 3A) are available into which a wide variety of cutter knife shapes (Fig. 4) may be inserted and locked in place. Two-blade, solid shaper cutters (Fig. 3B) are also available in a variety of molding shapes.

Raising and lowering or tilting the arbor (Fig. 4A) changes the position of the cutter in respect to the edge of the work piece and thus changes the contour or design of the molded edge. This increases the number of differently shaped molded edges that you can make with any single set of knives. When tightening the setscrews that hold the cutters to the molding head, place it on a flat surface as in Fig. 2 so that all the cutters will be flush with one side of the molding head and aligned with one another.

If the surface of the radial-saw work table is rough and scuffed up from use, cover it with tempered hardboard nailed in place



Tightening setscrews that lock inserted cutter blades securely to molding head.



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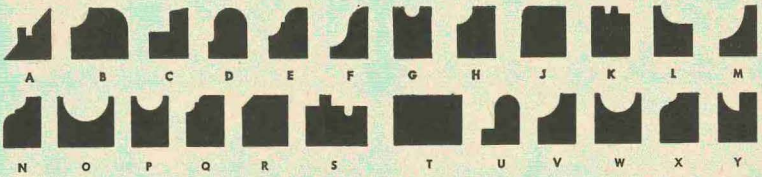

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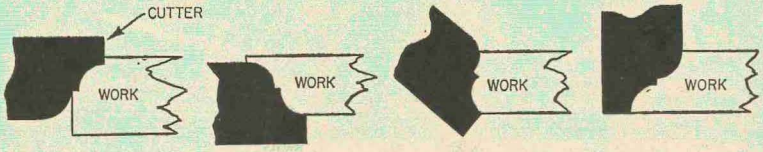
A. Miter Lock Joint
B. Drop-Leaf Table
C. Cupboard Door Lip
D. Fluting Cutter
E. Bead and Cove
F. O. G. Molding
G. Nosing Cutter
H. Quarter Round
J. Panel Raising
K. Glue Joint
L. Cupboard Door Lip
M. Quarter Round
N. Cove and Bead
O. Nosing Cutter
P. Nosing Cutter
Q. Bead and Cove
R. Surfacing Knives
S. Tongue and Groove
T. Straight Jointer
U. Fluting Cutter
V. Quarter Round
W. Nosing Cutter
X. Cove and Bead
Y. Cupboard Door Lip (7° rake)



A POSITION OF CUTTER IN RELATION TO WORK DETERMINES SHAPE OF EDGE

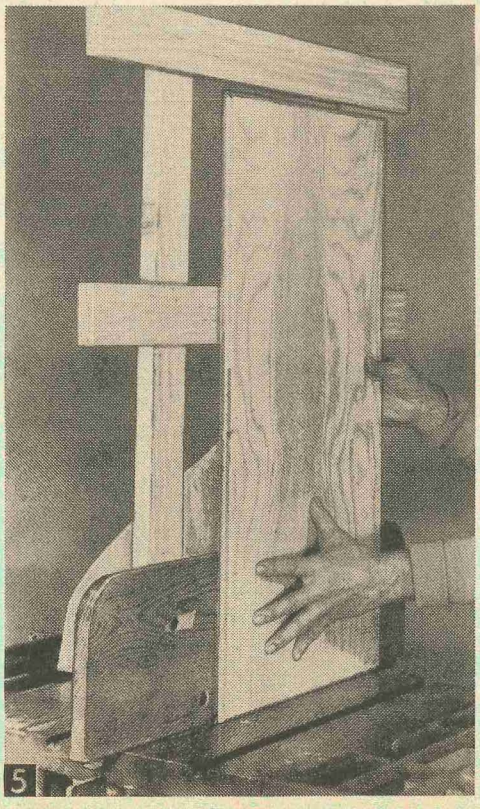
to provide a smooth surface on which to slide the work pieces and minimize friction.

Although a two-piece shaper fence can be made as in Fig. 6A to replace the regular fence, a special jointer-shaper fence attachment is available for the radial saw shown in Fig. 1. This fence has the advantage of having the infeed side of the fence adjustable (Fig. 6B) for up to ½-in. depth of cut. This feature is, of course, necessary when jointing the edge of a board to remove a predetermined amount of stock. However, it is also useful when molding the edge of a piece of stock, because you can set the fence to remove just a slight amount of the original edge of the stock and still have it supported on both the infeed and outfeed sides of the work piece. This makes for an absolutely straight molded edge, an operation that isn't possible when shaping the edge of stock with a molding head mounted on a circular saw unless a special fence having an outfeed shim is used.

When using a molding cutter of a design that requires removal of considerable stock, such as a miter lock joint or a deep O.G. curve, take two or three passes, each progressively deeper with a fine cut on the last pass for a smooth finish. Depth of cut is controlled by movement of the saw carriage on the radial arm. Be sure to lock the carriage in place with the rip clamp. When adjusting the carriage for the last pass, use a wooden straightedge as in Fig. 6C to position the cutting edge of the molding-head shaper blades that remove the least amount of stock in line with the stationary or outfeed shaper fence. The infeed fence should be set with just a hair's width clearance between it and the straightedge.

Hold the work piece down on the saw table and against the fence (Fig. 1) as you slowly and uniformly feed the work past the molding cutters. When shaping a molded edge around all four edges for a lipped cupboard door for example, make the first cut across the end grain and follow around the piece as indicated by the numbered steps in Fig. 6D, making the last cut with the grain. By following this procedure you will trim away the splintered end of the end-grain cuts.

To avoid splintering when only the end-grain edge of a large piece of work is to be shaped, clamp a piece of scrap



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Edge shaping with a molding head on a circular saw requires the use of a high sturdily-built, rip fence attachment to keep the work square with the top of the saw table.

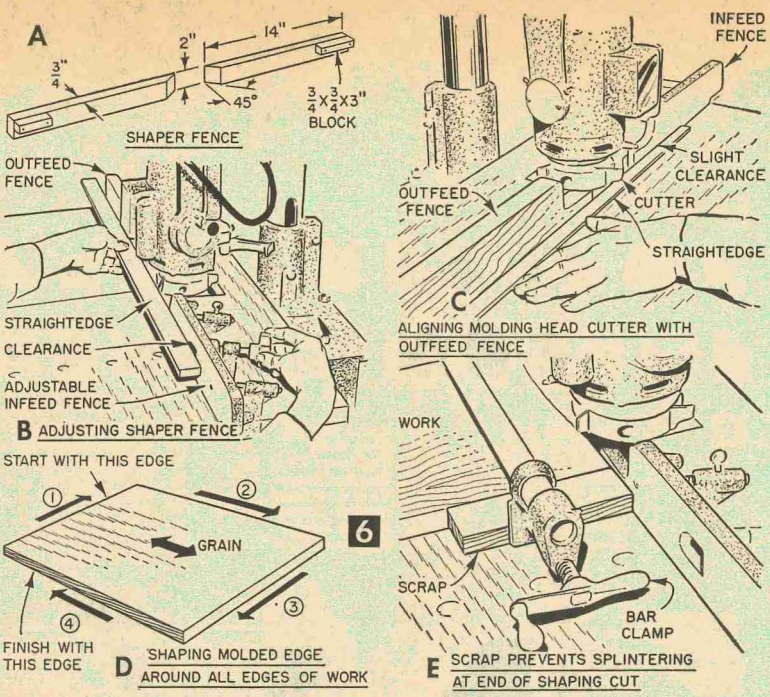
wood of the same thickness to the edge of the piece as in Fig. 6E. This method should be used when shaping the edges of plywood, too.

There are two methods of guiding large circular pieces of stock when cutting a molded edge on them. The simplest setup is to clamp two boards, having their ends cut at an angle as in Figs. 7 and 7A, to the radial saw table to serve as a depth and centering guide. The equal distances at which to clamp them at each side of the molding head will depend upon the size of the work piece. This can be determined by simply holding the accurately band-sawed work piece on the saw table in front of the molding head and sliding the guide boards along the fence until they touch the edge of the work. After removing the work piece the equal distances (Fig. 7A) can be checked and the guide boards clamped in place.

Position the saw carriage to take a light cut and slowly rotate the work piece against the rotation of the cutters, while holding it firmly against the guide boards and flat on the table. Then reposition the saw carriage for each successive cut until molded edge is completed. If the final cut is to remove some of the original diameter of the work, an extremely fine cut must be taken on the last pass to avoid having a hump in the molded edge as the smaller diameter contacts the outfeed fence.

A pivot jig (Fig. 8) assures perfect roundness regardless of how much of the original diameter is to be removed. However, with this method a blind hole must be drilled on the underside of the work at the center to take the jig centering pin or pivot. If the piece is to be a table top this would not be objectionable. Clamp a stop block (Fig. 8) to the radial arm to limit the depth of cut.

When starting the motor, move the carriage back so that the cutter clears the work, then slowly bring the carriage forward to the stop block and lock it with the carriage clamp. The work must be held down tightly against the jig boards with your left hand when the cutters engage the work to prevent the tendency of the cutters to spin the work piece. Once you start the molding cut, the spinning tendency will diminish. After completing one revolution of the work piece, reposition the carriage stop block to permit a greater depth of cut and repeat the procedure.



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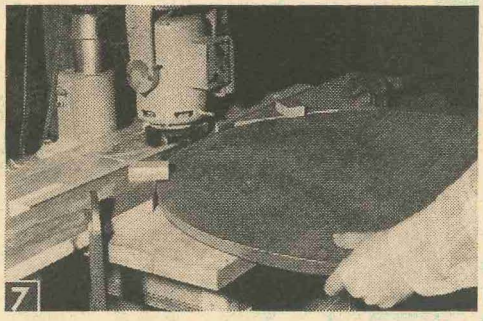

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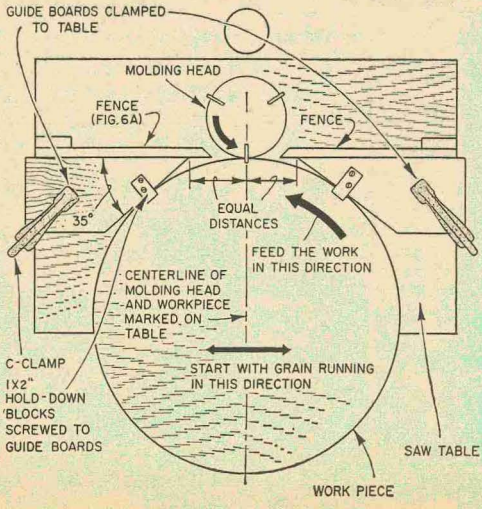


7 A JIG FOR SHAPING EDGE OF CIRCULAR WORK

Two concave guides fastened to a sheet of plywood clamped to the saw table as in Fig. 9 become a jig for edge molding segments of a circle. Often the pieces of scrap cut from the work can be used for the guides. The outfeed or left-hand guide should have a slightly smaller radius and be offset that much toward the segment to compensate for stock removed from the edge of the work piece during the molding operation. Since each guide must direct the work piece alone at the beginning and end of the cut, make the guides long enough to extend across at least 60° of the segment circle.

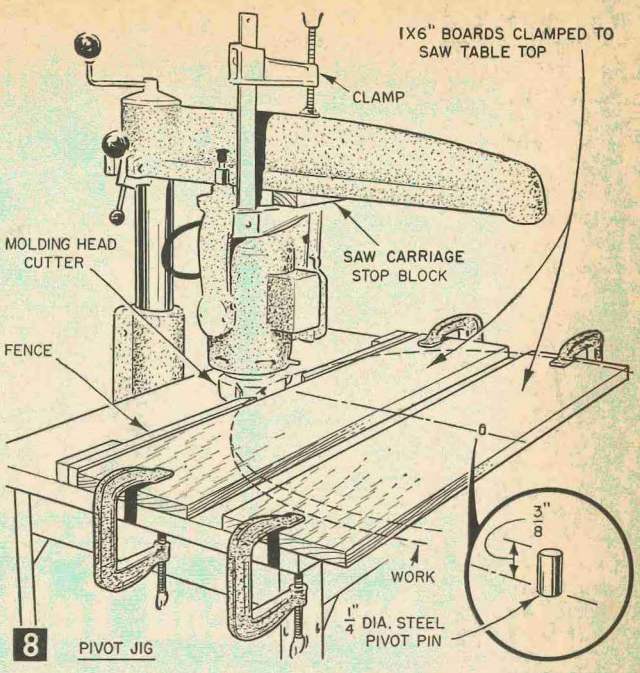
Although concave or inside edge molding of large segments is seldom used in home workshop construction, you can accomplish it by reversing the curve of the jig guide pieces; that is, make them convex instead of concave as for molding the outside edges of segments.

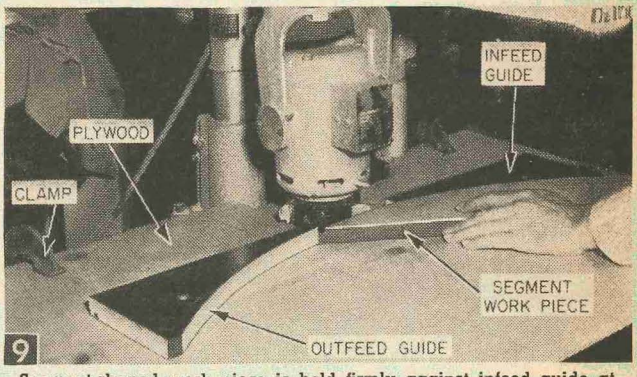
Shaping special size, large cove moldings having a radius up to 3½ in. can be done faster with a molding-head cutter (Fig. 10), and produces a smoother surface requiring less sanding than when the cove is cut with a saw blade or dado head. Choose a molding head knife design that has a concave cutting edge on the right side like a combination drop-leaf table cutter or a wide fluting cutter (Fig. 4). A set of O.G. molding cutters could also be used by grinding a straight cutting edge on the right side of the cutters. If the cove is to be deeper than the cutting edge on the right side of blades, you can take several passes to complete the cove.

The radius of the cove is determined by the angle at which the saw carriage is set off the cut-off position. The closer it is turned toward the rip position, the smaller the radius becomes. Run a cut in a piece of scrap stock first to determine the exact setting needed.

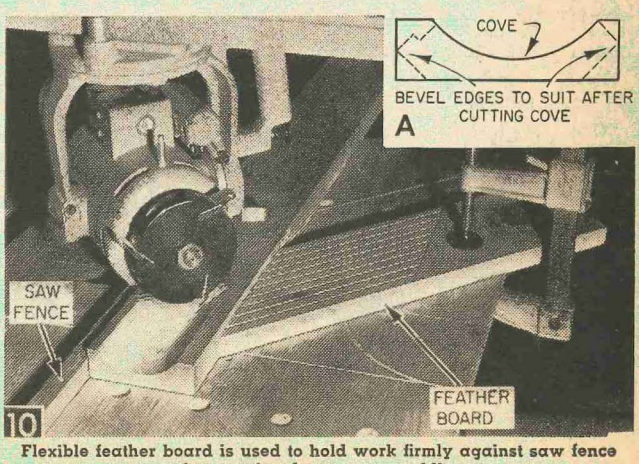
Use the regular saw fence and clamp a feather board to the table top to keep the stock firmly against the fence.

If the stock is long enough to bow under its own weight, you must provide supporting tables at infeed and outfeed sides of the table. After cutting the cove, saw or joint the beveled edges as in Fig. 10A to suit the particular job on which the coved molding is to be used.





Segment-shaped work piece is held firmly against infeed guide at start of molding cut and against outfeed guide at finish of cut. Shaper guard removed from radial saw to show position of molding head.



Flexible feather board is used to hold work firmly against saw fence when cutting large cove molding.

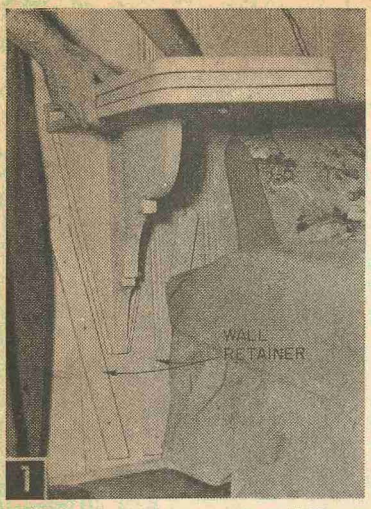


Fig. 1 (Left) Table may be quickly removed for storage by lifting out of wall retainers. Fig. 2 (Right) Swinging top in opened position projects conveniently in front of person sitting on davenport.

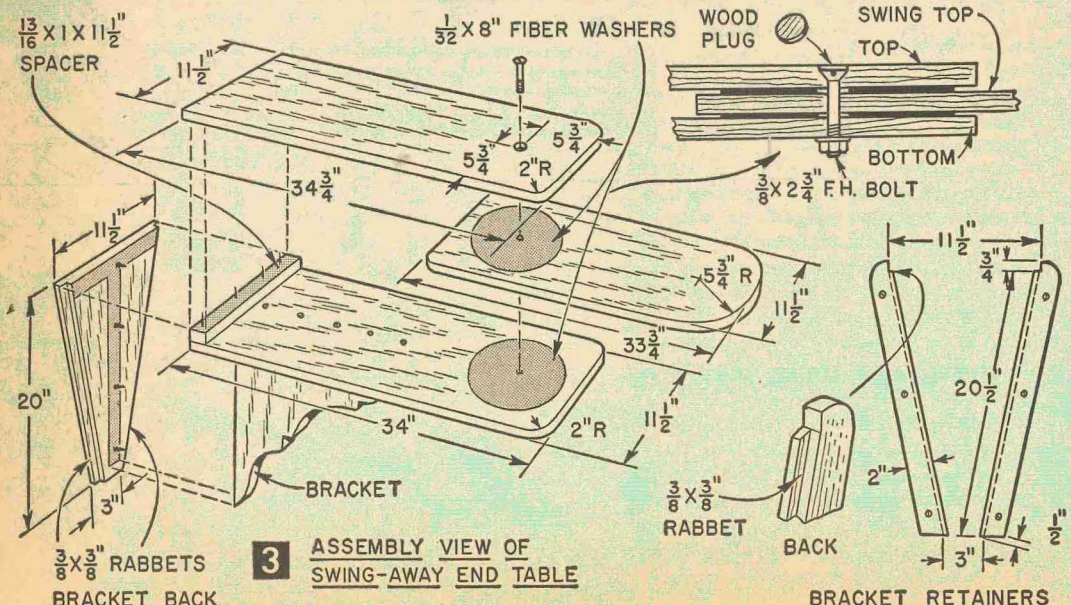
Swing-Away End Tables

By ED SCARDELLI

HERE'S an idea for making davenport or studio couch end tables that have an additional top or leaf which can be swung out to provide nearly twice the usual table-top area. These tables will come in mighty handy when serving TV snacks, because the usual lamp, books and ash trays on an end table need not be moved. You merely swing out the center-piece to a convenient position in front of the person sitting on the davenport.

Then too, there are no table legs extending to the floor to interfere when cleaning house. Instead, the tables are supported by wall brackets and may be quickly removed for storage in a closet.

Although the table in Fig. 1 was made of pine to harmonize with the knotty pine walls, any type of wood could be used. Make the tops first, by clamping together three pieces of ¾ x11½ x 34-in. stock and cutting all to the same shape as in Fig. 3. Sand the edges and drill a ⅜-in. hole through all three pieces. Counterbore the top side ⅛-in. deep and to a diameter slightly larger than the *fh* ⅜-in. bolt for a wooden plug to cover the bolt head. Countersink for the bolt head. Remove the clamps and cut the swing-top board

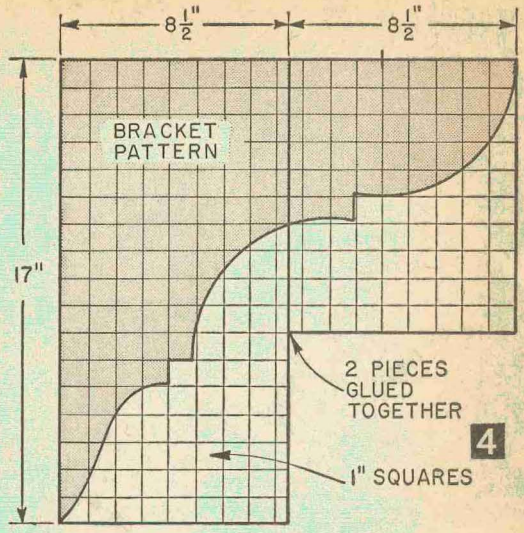


3 ASSEMBLY VIEW OF SWING-AWAY END TABLE

1 in. shorter, rounding the end as in Fig. 3.

Joint and edge glue two pieces of 1¾-in. thick stock and saw out the bracket (Fig. 4). Make the bracket back from ¾-in. solid stock with a ⅜ x ⅜-in. rabbet along the two diagonal edges. Then fasten the bracket to the center of the back with glue and four #8 x 1¾-in. *fh* screws and the bottom board of the table top to the bracket and top edge of the bracket back with five #8 x 1¾-in. *fh* screws. Glue and nail the 13/16-in. thick spacer to the top of the bottom board. Temporarily assemble the top and swinging top complete with large fiber washers and ⅜-in. bolt to see that everything is in good working order. Disassemble and set aside for a moment while you make up the two bracket retainers (Fig. 3).

The type of finish you apply will depend upon the wood used. The table of pine shown was given four coats of 4 lb-cut shellac thinned 50% with alcohol followed with three applications of paste wax. If open grained wood such as oak, walnut or mahogany is used, a wood filler must be applied before finishing. Finish all of the parts except the table top. Then reassemble the top and swing top, glue a wooden disc or plug to cover the head of the ⅜-in. bolt, sand and finish the top as you did the other parts. Locate and fasten the bracket retainers to the wall with wood screws (toggle bolts if wall is plastered) and set up the table by lowering it between the two retainers. To remove the table, merely lift it is in Fig. 1 until the ⅜-in. rabbets are clear of one another.

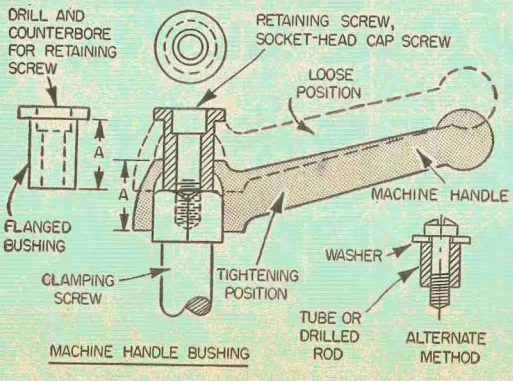


MATERIALS LIST—SWING-AWAY END TABLE

No.	Size and description	Use
1	1 x 12" x 12' pine (13/16 x 11½" x 12' net size)	tops and bracket back bracket retainers
1	13/16 x 2" x 4' pine	bracket
1	1¾ x 8½ x 28" pine	
12	#8 x 1¾" fh screws	
1	⅜ x 2¾" fh bolt	
1	1/32 x 8 x 16" fiber	washers
	(for two tables double the above amount)	

Improving Machine-Tool Handles

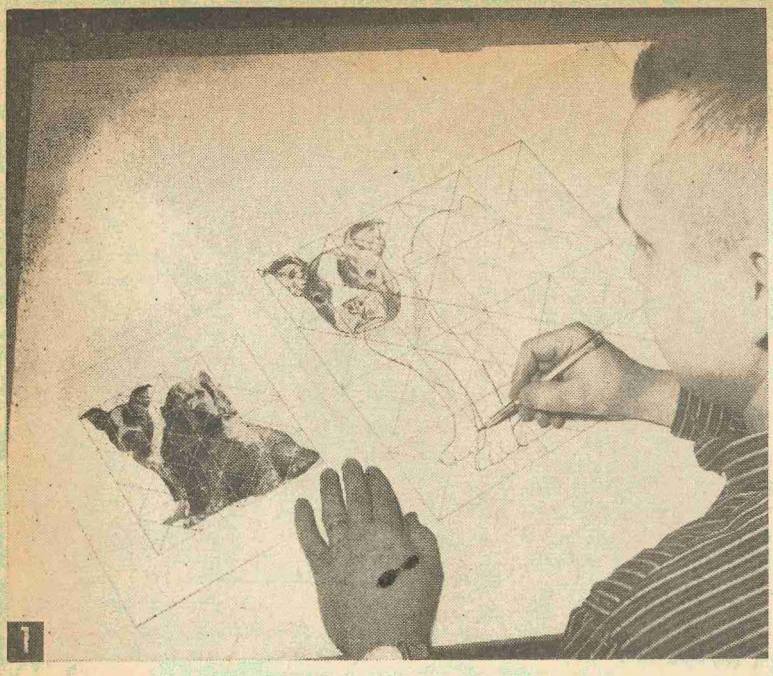
THE clamping screw handles on many machine tools are actually wrenches which are normally held on the head of the clamping screw by means of a small retaining screw. Often, when handles of this type are tightened, they are in a position which interferes with convenient operation of the machine. The retaining screw can, of course, be removed and the handle relocated in a more convenient position provided there is clearance for the handle in the open position. The retaining screw can also be left off and the handle used as a wrench, removing it each time it is used. But, then there is always the possibility of misplacing or losing the handle.



By making the flanged bushing (illus.) and using a longer retaining screw, the handle will always be attached to the machine yet can be swung out of the way.

Make the diameter of the bushing (B in illus.) about 1/16 in. less than the distance across the flats of the clamp screw and redrill the retaining screw hole in the handle to take the bushing. Make the length of the bushing (A in illus.) equal to or slightly longer than the distance A on the wrench. Drill and counterbore the bushing to take a retaining screw of the same thread size as the original one but longer and assemble handle and bushing to clamping screw. In use, slide the handle on the clamping-screw head for tightening and back against the flange on the bushing to swing out of the way.

If you do not have a metal-turning lathe to make the bushing, a suitable substitute can be made from a length of tubing or rod drilled through the center and a washer as shown in the alternate method.—JOHN M. AVERY.



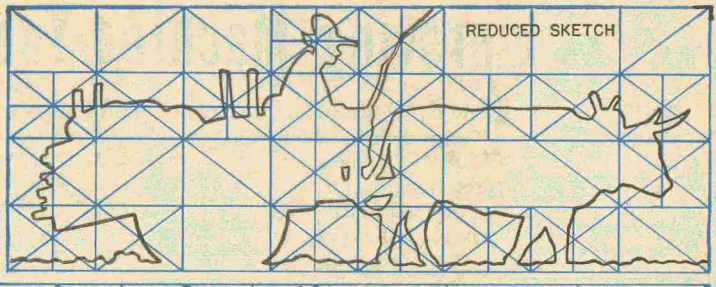
Enlargement need not be limited to the same proportions as the original when you use the rectangle-triangle system as a guide. In the "blow-up" at right, craftsman has increased vertical dimension more than the horizontal.

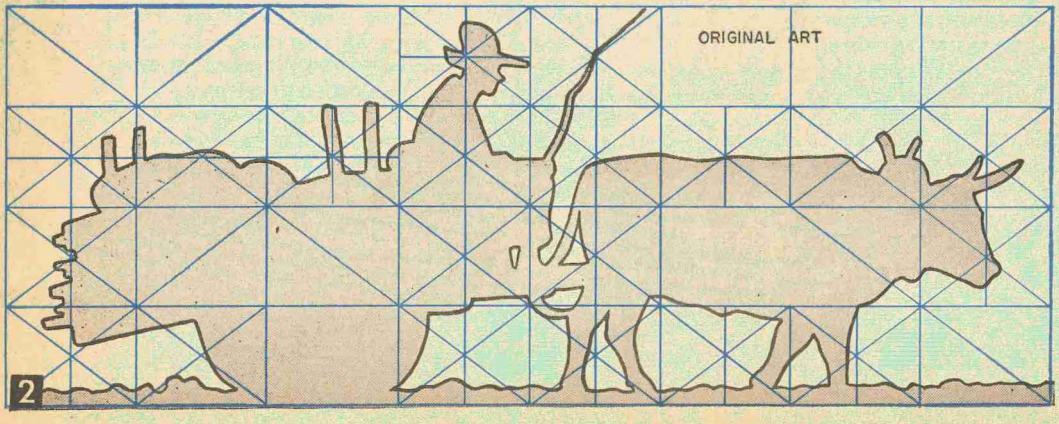
Easy Way to Enlarge or Reduce Patterns

HERE is a quick and easy way to "blow up" or reduce a pattern to the size you need, without being restricted to the same proportions. You can also adapt it to special effects—such as intentionally emphasizing a partially distorted appearance on a pattern.

Begin by boxing in the pattern you intend to enlarge with a rectangle that just touches the edges of the pattern or drawing. Draw in diagonals from the corners of the rectangle. Where they cross in the center, draw a horizontal and a vertical line. Draw additional diagonals connecting the points where these lines touch the borders of the rectangle. To avoid marking the original work, draw the lines on a tracing paper overlay.

The lines break up the pattern into a series of triangles, most of them including parts of the design. You can ignore those





triangles which either skip the design or are a solid part of it. In sections where the design is complicated, however, add more vertical, horizontal and diagonal lines, connecting points of intersections. This breaks up the pattern into smaller, easier-to-transfer areas such as those around the puppy's nose and eyes in Fig. 1. The smaller the triangles over heavily-detailed work, the more accurate your reproduction should turn out.

You can reduce a large drawing by the same rectangle and triangle grid method, as in Fig. 2. In this instance, however, since the pattern is wide and shallow, note that a vertical line was drawn first to divide pattern in half, creating two rectangles. After this preliminary division, you can mark in the diagonals for each half and proceed as before.

To Transfer the Pattern, use plain paper and lightly lay out a rectangle you desire for the enlargement or reduction. Don't be concerned if your overall dimensions are not in strict proportion with the original rectangle. The proportion is not automatic, as in the case of photographic or photostatic reproduction.

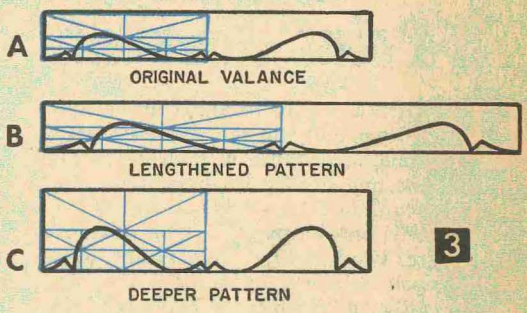
Draw in the diagonals for the new rectangle and follow with other lines in same relative position as before until the line patterns of both grids match.

Now you can sketch in the details easily by considering each little triangular area as a separate picture in itself, sketching all object lines within its borders in the proper location. At any time you run into detail to cause trouble in copying, merely break up the original rectangle into still smaller triangles, reproduce them on the new sketch and you will find them a great improvement toward accurate transcribing.

If you wish to enlarge the rectangle in only one direction because you already have the right height or length, the same system will prove satisfactory, as in Fig. 3 showing a valance pattern converted into deeper and longer variations. It's best in such symmetrical designs to draw only half the pattern and flip it over to trace the other half.

Distorting a Drawing in one direction or another is accomplished simply by converting the rectangle into a trapezoid as in Fig. 4. Connect the diagonals from the corners, then draw in the crosslines and more diagonals to intersecting points in the same manner. Sketch in the enlargement as in Fig. 4, being careful to proportion points where drawing crosses guide lines to match the original sketch. Still smaller triangles may help you complete this job.

For a neat job, erase all pattern marks before applying color or other finishing touches.—DAVID M. SWARTWOUT.



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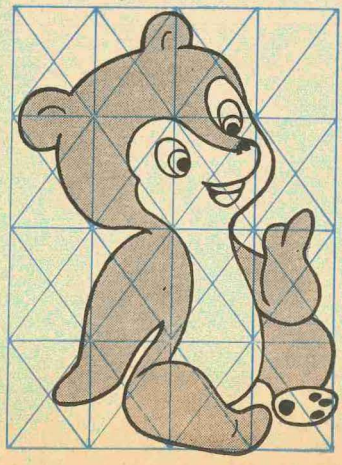

ORIGINAL

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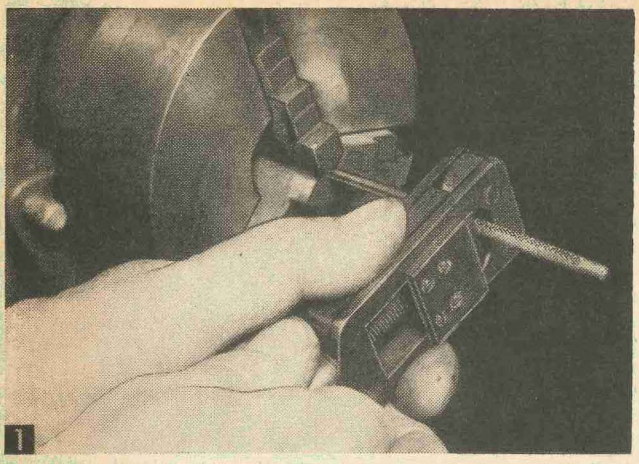
DISTORTED ENLARGEMENT



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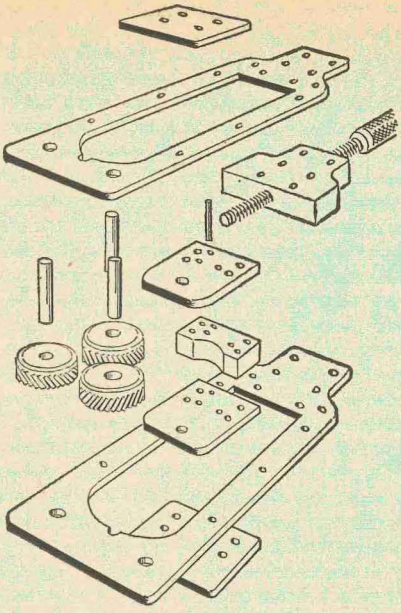
Here's how the hand knurling tool makes easy work of a typically tough job; knurling a small 3/16" brass handle. Use plenty of lubricant.



3-Point Knurling Tool

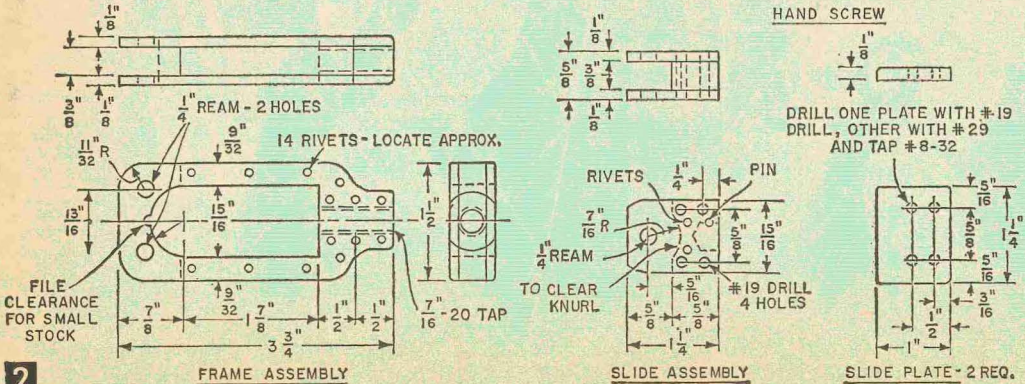
USE THREE rollers to knurl instead of the usual two, and you can add the truly professional appearance of knurling to knobs, instruments, and small parts even if you want to do it without a metal lathe.

Ordinarily, knurling is done with a lathe tool, that presses two knurling rollers against one side of the revolving work. In knurling, the metal is not cut; rather it is formed, by pressure, and thus it is usually difficult to knurl small parts, especially of soft brass and aluminum. This tool will knurl rods from 3/4" down to 3/16". And because it provides its own pressure, you can use it in your drill press, as well as in the lathe. You can even clamp the work in a vise and rotate the tool by hand.

The first step is to buy the knurls, which are available in diamond or straight pattern, from any tool supply house. While they come in coarse, medium, and fine pitch, the fine diamond pattern is your best choice for most small work. If you have a milling machine, or metal cutting bandsaw, the frame can be made of solid stock. Otherwise, Fig. 2 shows how to make it by riveting together three pieces of steel plate.

To make the frame using the latter method, clamp steel plates A, B, and C together, and drill rivet holes in several places. The hole size will depend on the rivets that you have available. They can be made from 1/8" cold rolled steel round stock, or you can use #8 finishing nails, which would require a #34 drill. Countersink the holes about 1/64" on each side, and rivet the three pieces together temporarily. Now, scribe the layout on one side, and complete all the drilling.

A good method of cutting out the recess for the slide is to drill a series of 1/8" holes spaced 1/8" apart all around the inside of the outline, with



2

MATERIALS LIST—KNURLING TOOL

No. Req.	Size and Description	
2 pcs	1/8 x 1 1/2 x 3 3/4" cold rolled steel	Finished size
1 pc	3/8 x 1 1/2 x 3 3/4" cold rolled steel	
2 pcs	1/8 x 1 x 1 1/4" cold rolled steel	
2 pcs	1/8 x 15/16 x 1 1/4" cold rolled steel	
1 pc	3/8 x 5/8 x 15/16" cold rolled steel	
1 pc	5/8" dia. x 4 5/8" cold rolled steel	
3	3/4 x 3/8" knurling rolls—1 R.H. and two L.H. or 1 L.H. and 2 R.H.	
4	#8-32 x 7/8" fill. hd. machine screws	
	1/8" rod or nails for rivets	
1	3/16" steel bearing ball	

the holes not quite touching the layout line. Then knock out the center, and finish by filing. A 3/4" mounted grinding wheel chucked in the drill press is also handy for finishing the recess.

Remove the excess metal on the screw end of the frame, by drilling and filing. Then, take the three pieces apart and cut 3/4" off the center piece to clear the knurls.

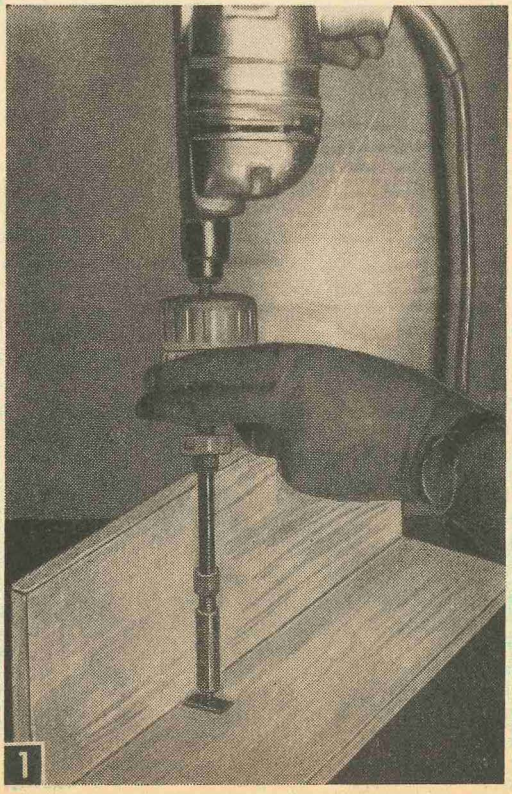
After reassembling the three pieces, fasten them permanently together with rivets in each hole, peening them down well into the countersunk ends of the holes. File both sides of the frame smooth, and then chuck the frame in the lathe and drill and tap the threaded screw hole.

Construction of the slide assembly is similar to the frame, but it consists of five pieces of steel plate, with the outside slide plates held by screws. Rivet the center portion together, and then clamp the two side plates to it for drilling with the #29 drill. Then remove one side plate, and enlarge the holes in it and the slide with a #19 drill, to take the 8-32 screws. Tap 8-32 holes in the other side plate.

Turn the hand screw on the lathe, and include a small center in its end for the 3/16" thrust ball. With the screw installed in your frame and slide, drill the pin hole through the slide to locate the groove, which is turned on the lathe.

The tool is now ready for final assembly. Knurls have 1/4" ground holes, which permit them to turn freely on 1/4" pins, which you can make from unhardened drill rod. Countersink the pin holes in the frame slightly, and peen the pins lightly to hold them in place. They can be easily punched out, when you want to change knurls.

The tool is used by clamping it on the work, and slowly pushing it along as the work rotates, with plenty of oil to act as cutting and heat-removing lubricant. You can also knurl small head screws and knobs, simply by clamping down the tool and revolving it, while the work is held in a vise or stationary chuck.—T. L. STALKER.



Screwdriver attachment in operation. Note finder has located screw head, and long bit permits speed reducer to clear 6 in. backboard.

SCREWDRIVER ATTACHMENT

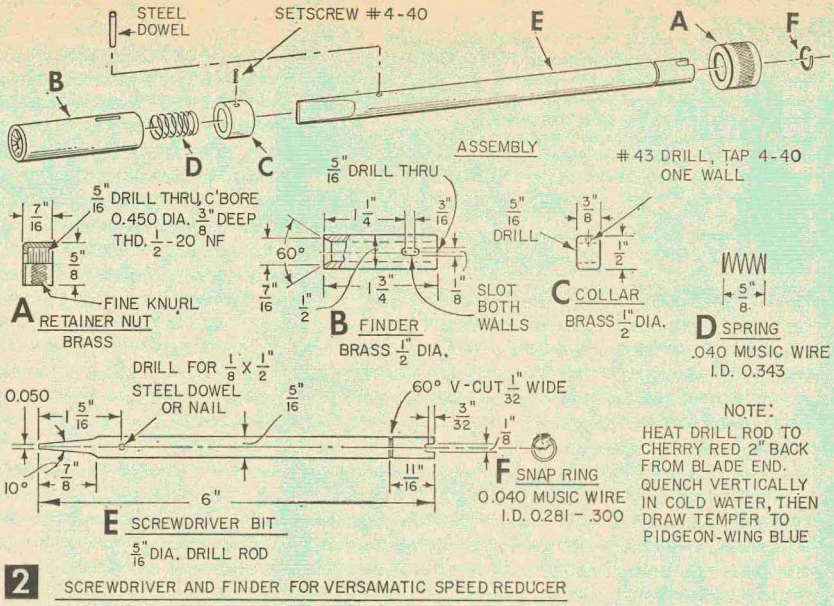
COUPLED to a *Versamatic* speed reducer on a 1/4-in. electric drill as in Fig. 1, the screwdriver attachment will automatically position the screwdriver bit in the screw-head slot and hold it there until the screw is driven.

In use, the finder (Fig. 2) is placed over the screw-head (screws must be previously tapped in place with a hammer), and, with a slight driving pressure, the bit will engage the slot during the first half turn. The spring-loaded finder will then prevent the screwdriver bit from slipping out of the screw slot and marring the work, and, being spring loaded, a flat-headed screw may be driven flush with the work surface. The 6-in. length of the bit will enable you to drive screws in hard-to-reach places too.

The retaining nut, finder and collar (Figs. 2A, B & C) are all made from a 5/8 x 4-in. brass rod (see Materials List). Chuck the rod in your lathe's 3-jaw chuck, and turn and drill the collar and finder first. Then cut off the collar, and chamfer the finder. Cut off the finder, and use balance of rod for making the retainer nut. Drill the two 1/8-in. holes through both walls of the finder, and file the slot between them to make a sliding fit with a steel dowel or nail. Drill and tap the collar for a #4-40x1/8-in. socket setscrew. Make the spring and snap ring from a 2-ft. length of .040-in. dia. music wire, or purchase a spring at a hardware store and cut off

coils to size.

Next make the screwdriver from a 5/16-in. dia. x 6-in. piece of drill rod or tool steel. The length and bit tip thickness can vary to suit the job requirements. The bit tip thickness is .045-in. for a #6 screw, .050-in. for a #8 screw, and .055-in. for a #10 screw. Chuck rod in lathe and turn a V-shaped groove for snap ring. Grind or file bit tip to required thickness, and drill hole for press fitting steel dowel or nail. Drill 1/8-in. hole at tail end of rod and file out notch.



2 SCREWDRIVER AND FINDER FOR VERSAMATIC SPEED REDUCER

To harden the bit, heat to a cherry red from bit tip to 2 in. back on the rod, then quench in cold water, holding the rod vertically to prevent warping. Remove discoloration from rod with emery cloth. To temper the bit, reheat at a point 2 in. back on the rod from the tip and note the metal as it takes on color. The first colors will be shades of brown followed by shades of blue which will flow toward the bit tip. When a pigeon blue color reaches the bit tip, quench the bit in cold water. Repolish the rod to a bright color with emery cloth.

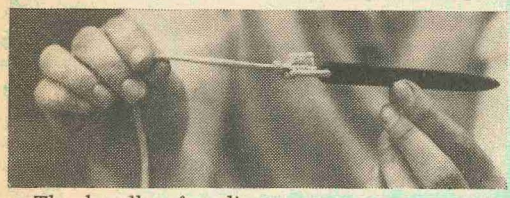
To assemble the parts, slide the collar, spring and finder onto the bit with chamfered end of the finder towards the bit tip. Drive the steel dowel or nail through the finder slots and hole in bit. Slide the collar back towards the finder until spring is compressed slightly, then tighten the collar onto the bit with the setscrew. Spring compression can be varied by adjusting the collar. Slide the retainer nut on bit with threaded end towards bit tail, and place on snap ring.

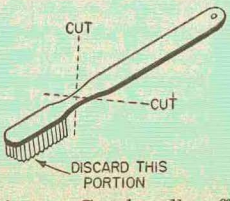
The tool is now complete, and after attaching to the Versamatic speed reducer with the retainer nut, is ready for use.—C. T. ALLEN.

MATERIALS LIST—SCREWDRIVER ATTACHMENT

Amt.	Description	Use
1	5/16 x 6" drill rod or tool steel	bit
1	5/8 x 4" brass rod	nut, finder and collar
2 ft.	.040 music wire	spring, snap ring
1	4-40 x 1/8" socket head setscrew	collar

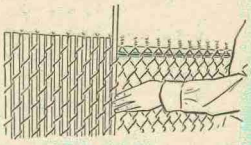
Toothbrush Handle Strings Along





• The handle of a discarded toothbrush containing a hole for hanging makes a handy tool for threading a drawstring or ribbon through a laundry or duffle bag and clothing, and may even be used as a fish stringer. Cut handle off at the narrowest point, sand and then buff to a smooth finish.—A. ZANELLI.

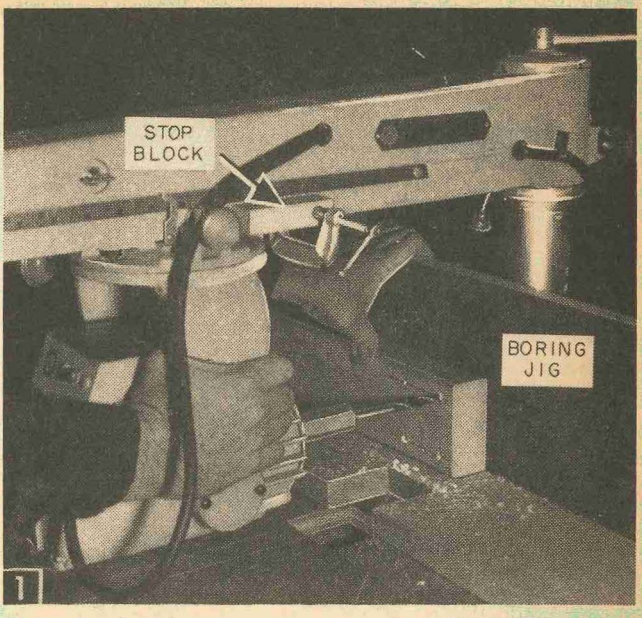
Fence Cover-Up



• You can add privacy to a woven wire fence or screen out unsightly areas, yet permit air and sunlight to enter, by inserting 1-in.-wide strips of Masonite 1/8 in. Tempered Presdwood through the openings. The weather-resistant slats needn't be painted.

Garbage Can Identification

• Paint your house number on garbage and ash cans to reduce the chances of the cans being lost or stolen. Galvanized steel cans should first be wiped with a cloth dampened in half-and-half mixture of vinegar and water, so that paint will adhere.—L. SCHUMACHER.



When face boring a piece of stock, center the drill horizontally by sliding the work to left and right and vertically by raising or lowering the radial-saw arm. Stop block clamped to saw arm stops saw carriage and prevents drill from going beyond boring jig.

Boring and Routing with a Radial-Arm Saw

By MILT EVANS

THE same sliding, swivel and tilt mechanism used when sawing with the radial-arm saw can be used for boring up to 1 in. holes in wood.

Unlike the conventional drill press, the radial-arm machine bores holes horizontally (Figs. 1 and 3) instead of vertically. There are no restrictions on the length or width of the stock you can bore as there is with a drill press due to its throat size or length of spindle feed. The depth of the hole to be bored on a radial-arm machine is limited only by the length of the drill bit.

Mounting the Drill Bit. First remove the saw blade and arbor collars from the motor shaft and screw on the drill-bit adapter, tightening it with the wrenches as in Fig. 2A. Then insert a bit of the required size in the adapter hole and tighten the retaining setscrew. Right and left-hand thread adapters for use at both ends of the motor shaft are available for the 1959 model De Walt saw shown in Fig. 1, so that either right or left-hand feed drill and router bits may be used. On older models of this radial saw only the left-hand adapter and left-hand feed drill and router bits can be used.

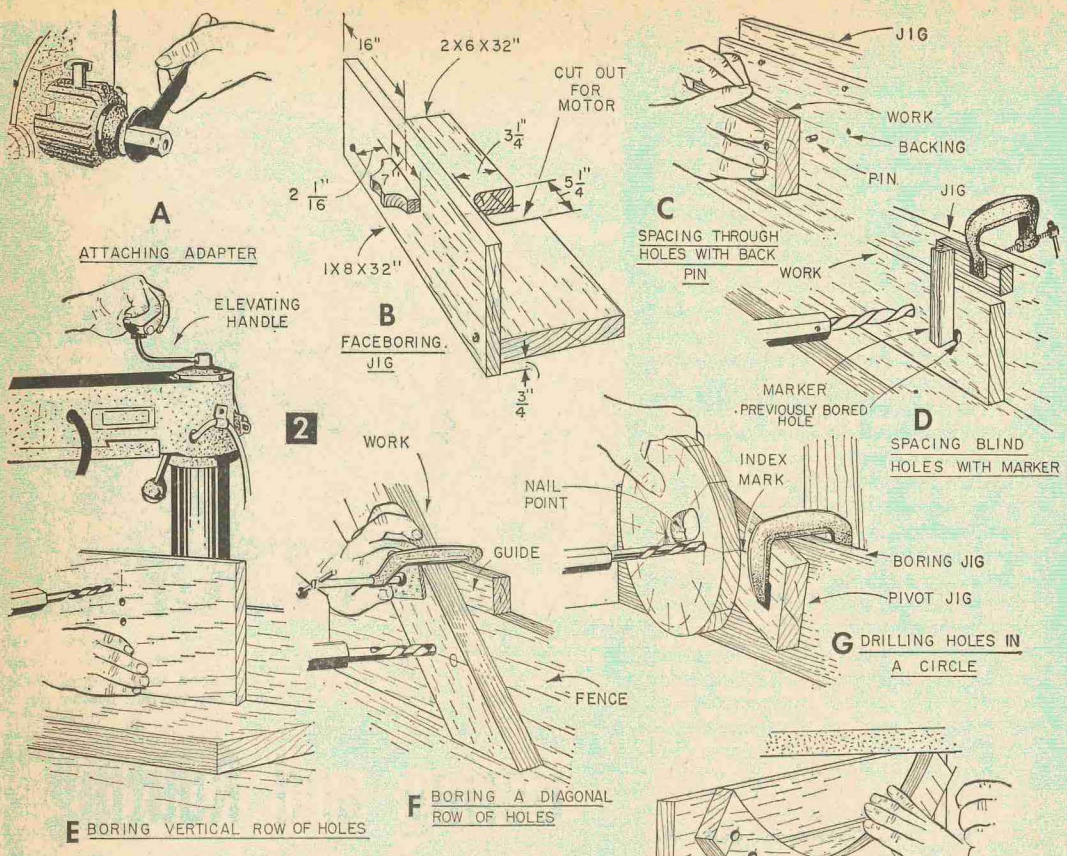
Wood-Boring Operations and Set-ups. To support the work at right angles to the saw table when face boring, make up the face-boring jig as in Fig. 2B and clamp it to the saw table as in Fig. 1 after removing the original guide fence strip on the table. Measure and mark the locations of holes to be drilled in the work with a sharp, hard pencil and "center-punch" with an awl. The punch mark will help lead the drill into the work accurately, especially when working with fir which has alternating hard and soft grain.

Align the drill bit with the marked locations of the holes on the work by sliding it from one side to the other on the boring jig and raising or lowering the saw arm with the elevating screw. Then feed the drill into the work by pushing the motor carriage. When drilling a deep hole, retract the drill once or twice to clear the chips and avoid burning the bit. To prevent the drill from going through the jig and striking the saw column, clamp a stop block on the saw arm as in Fig. 1.

When a series of equally-spaced holes is to be bored, set a short dowel into a backing board and temporarily tack the board to the boring jig (Fig. 2C), so that the pin will engage a hole already bored. Locate the pin so that the next hole bored will be correctly spaced. By entering the pin in successive holes they will be spaced as desired. If the holes are not to go through the work, make an ell-shaped marker from two blocks of wood and clamp it to the boring jig (Fig. 2D) where the marker will align with the edge of a previously bored hole, thus locating the next hole.

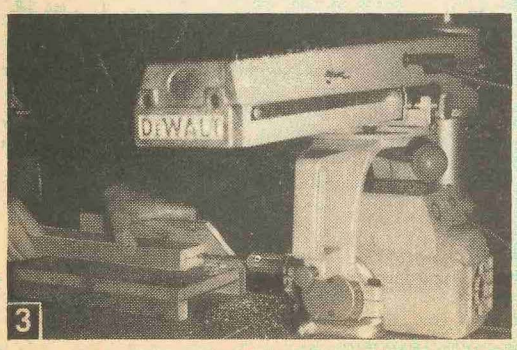
To space holes in a vertical row, raise or lower the saw-arm (Fig. 2E). A diagonal row of holes can be aligned by clamping a guide bar to the back of the work parallel to the row of holes as in Fig. 2F. Sliding the guide on top of the fence keeps work at desired angle. If the work is too large for this setup, handle it as in ordinary face boring, aligning the bit by sliding the work on the jig and raising or lowering the saw arm.

Holes arranged in a circle are easily located radially by use of a pivot jig consisting of a board with a nail point projecting which is driven into the back of the work centering on the hole layout circle. Clamp the pivot jig to the boring jig as in Fig. 2G. The work can be indexed by bringing a center line marked on the edge of the work to an index mark on the jig. Holes in segments are bored by resting the outer edge of the segment in



a guide made from the waste pieces sawed from the segment (Fig. 2H). Again indexing is by center lines brought to an index mark on the guide.

To bore holes into the edge of a piece of stock, lay the work face-down on the boring jig and against the fence as in Fig. 4A and proceed as for face boring. Mortising is accomplished by first boring holes at the ends of the mortise and then boring a series of holes between as in Fig. 4B. The remaining webs are removed by boring through them and working the piece lengthwise against the rotating bit. For boring edge holes in segments, use a horizontal setup similar to that for face boring segments as in Fig. 4C.



When end boring a piece of stock, guide and slide the work along the jig and against the drill bit.

End boring (Fig. 3) is done with the motor in normal sawing position and the piece resting on an end-boring jig built as in Fig. 5F. Clamp the jig to the saw table after removing the original guide fence and place the work on the jig. Adjust the saw arm for height, slide the motor along the arm to center the bit on the work, and tighten the carriage clamp screw. When boring, feed the work into the drill bit by sliding it along the jig fence as in Fig. 3. A stop block can be nailed or clamped to the jig to limit depth of boring.

When a hole must be bored in the face of a board at an angle, swing the saw arm, setting it at the desired angle on the column scale (Fig. 5A). If a hole must be bored into the edge of a board at an angle, tilt the board and rest it on angle blocks as in Fig. 5B. Such a setup is useful when boring dowel holes in the mitered edges of column staves. If a hole must be bored at an angle to both the width and length of a board, tilt the board and swing the saw arm to desired angle.

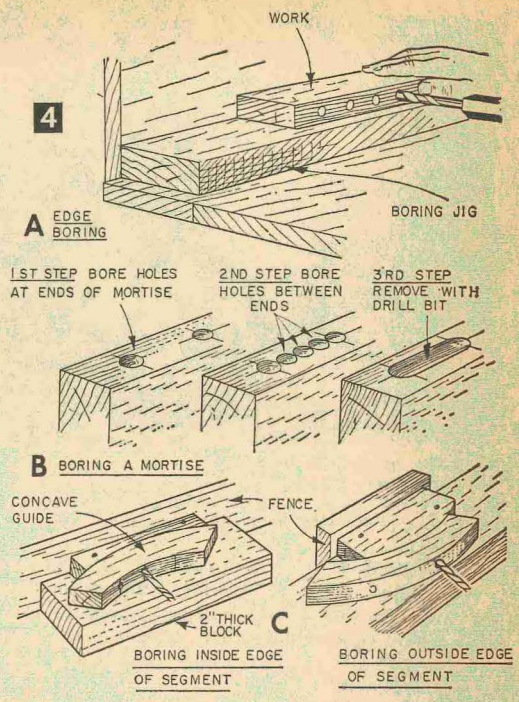
Frames with mitered corners are often strengthened by inserting dowels. This is a modification of end-boring, but with the piece swung away from the jig fence to bring the mitered edge at right angles with the drill bit. A block, cut to a 45° angle, and placed behind the work and against the jig fence can be used to position and hold the work while boring as in Fig. 5C. More convenient for angle boring is a jig made from two pieces of plywood as in Fig. 5D. A wing nut on a carriage bolt, with the head sunk flush into the underside, locks the swiveling member of the jig at any angle. Face the working edge of the jig with sandpaper to prevent work from slipping, and mark the angles on the base of the jig with a sharp pencil. In use, place the work on edge as in Fig. 5E and space the holes by raising or lowering the saw arm.

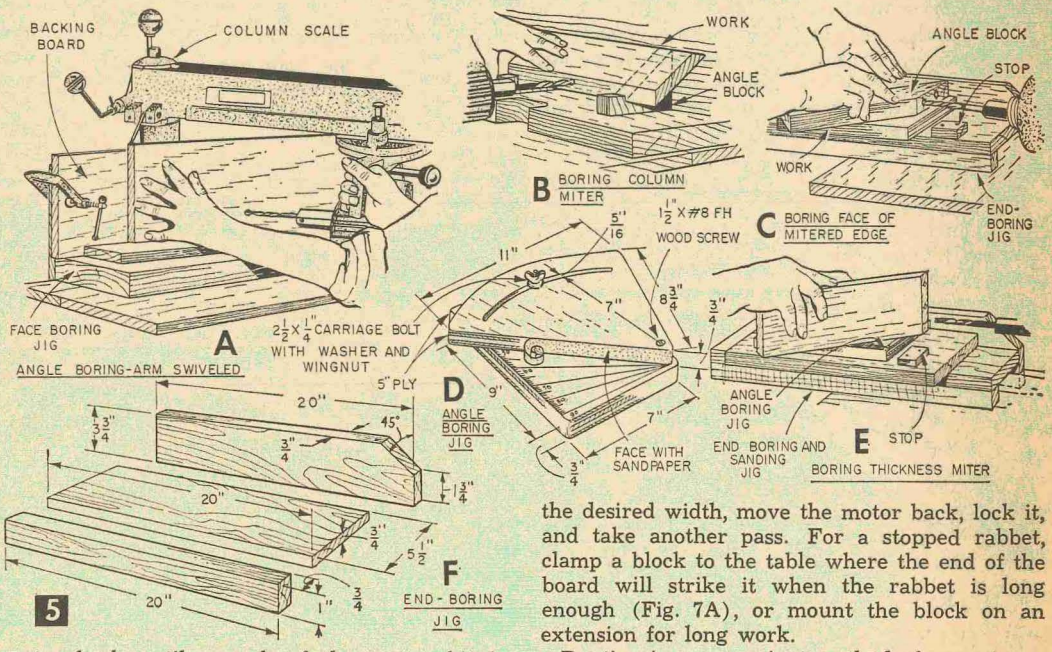
Routing. By substituting a router bit for the drill bit the radial-arm saw becomes a routing machine. The router bits, which are available in several sizes, are held in the boring bit adapter. Set the motor in a vertical position (Fig. 6), and rest the work on the table. If the surface of the table is cut up and rough from use, tack ⅛ in. tempered hardboard over it.

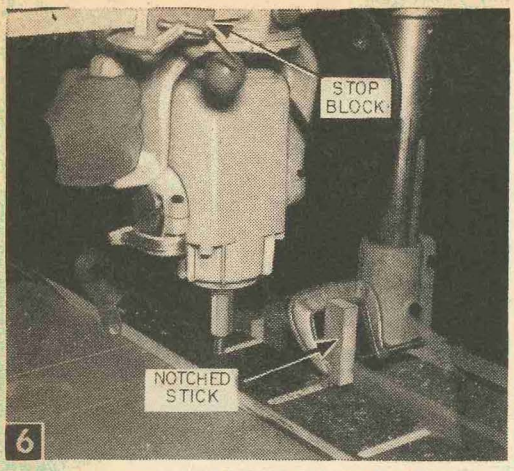
Cutting a rabbet along the edge of a piece of stock is a typical routing job. To do this, set the saw arm at right angles to the fence, push the motor back until enough of the router bit is forward of the table fence to cut the width of the rabbet. Then lower the motor so that the router bit will take a cut ⅛ in. or less in depth. For deeper cuts, make several passes each ⅛ in. deep. Lay the work face down on the table with the edge to be rabbeted against the fence, and feed forward to the left, as in Fig. 7A. If the router bit is not large enough to make the rabbet the desired width, move the motor back, lock it, and take another pass. For a stopped rabbet, clamp a block to the table where the end of the board will strike it when the rabbet is long enough (Fig. 7A), or mount the block on an extension for long work.

Routing is a convenient method of recessing a window-screen frame for the molding. By tacking a wooden wedge to the table to limit the width of the rabbet, the inner edge of the frame can be slid against the wedge while being held at right angles to it (Fig. 8). It works well into the frame corners, leaving little chisel work to square the corners.

When end rabbeting a piece of stock, hold the







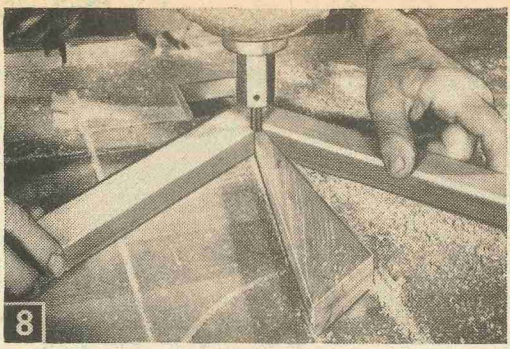
Routing grooves in the side of a small cabinet for shelves. Depth of the groove is controlled by height of saw arm, width by size of router bit and length by stock block clamped to saw arm.

work against the fence and pull the motor toward you to make the cut (Fig. 7B). Extend the piece to the left so that cutting will be against the rotation of the router bit. When rabbeting the edge of discs use a vee or fitted edge guide, or a pivot jig as in Fig. 7C.

The router bit can also be used for grooving and dadoing by following the same methods as for rabbeting, except that the cut is wholly enclosed. Make the start of a blind groove by lowering the router bit into the wood as you would a drill. Use the boring jig to raise the work high enough for edge grooving (Fig. 7D).

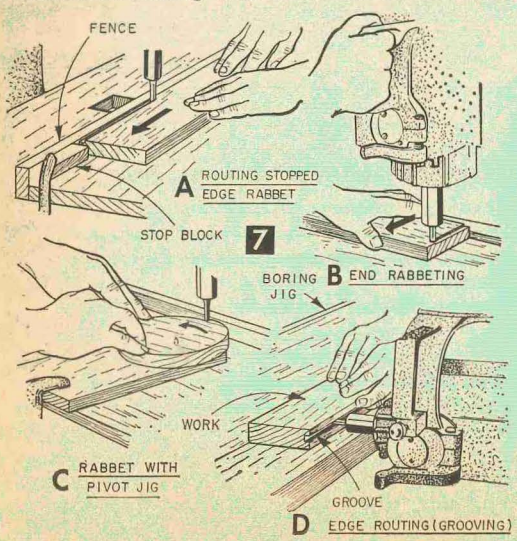
When dadoing a series of equally spaced cuts place a notched stick into a previously cut dado, clamping the stick to the fence where, when entered in the first cut, it will bring the next cut properly under the router bit (Fig. 6). Clamp a stop block to the arm when making blind dadoes.

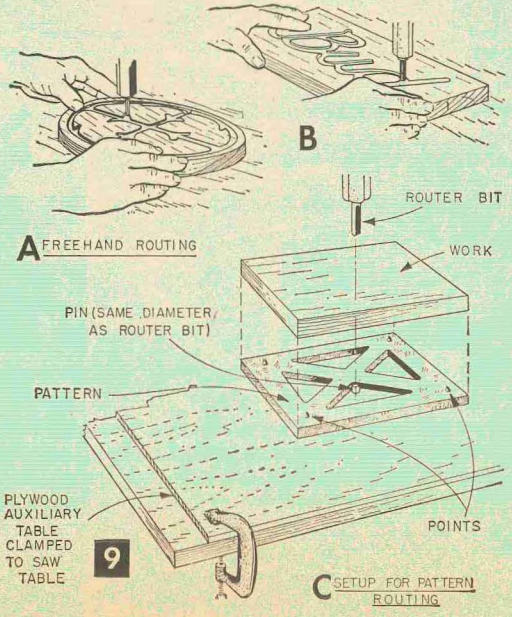
Freehand routing (Fig. 9A), is useful for planing down the backgrounds of carvings and making sunken or carved lettering in signs (Fig. 9B). For this work set the motor vertical and locate it near the center of the table where the work piece can be slid around under the bit. Use a bit having a diameter equal to the narrowest portion of the design.



Rabbeting a window screen frame for the screen and molding. The wedge-shaped guide, nailed to the table, assures uniform rabbet width and works well into the corners.

Freehand routing is likely to produce cuts that are somewhat irregular because the bit tends to follow the soft grain of the wood. Accurate outlining of a design, however, is possible with pattern routing, providing the pattern, jigsawed from thin plywood or hardboard, is accurately cut and smoothed. The pattern is tacked to the underside of the work piece (Fig. 9C). A dowel the size of the router bit is sunk in an auxiliary table, and the router is exactly centered on it. Then the pattern is lowered over the dowel until it rests on the table, the cutter is lowered into the work, and routing proceeds by guiding the pattern against the dowel.





Cobbler's Bench Coffee Table

By NORBERT ENGELS

NO SHOES are allowed on this cobbler's bench, which is really a decorative and commodious coffee table. Where once a shoemaker would have kept his leather findings, we keep books; where he kept nails, we might store cigarets, matches and perhaps a potted plant. Where he would have sat, we could keep magazines and a bowl of short-stem flowers. To top it off, there is a sizable drawer to hold playing cards, pencil and pad or photographs.

Photos by Kunkle

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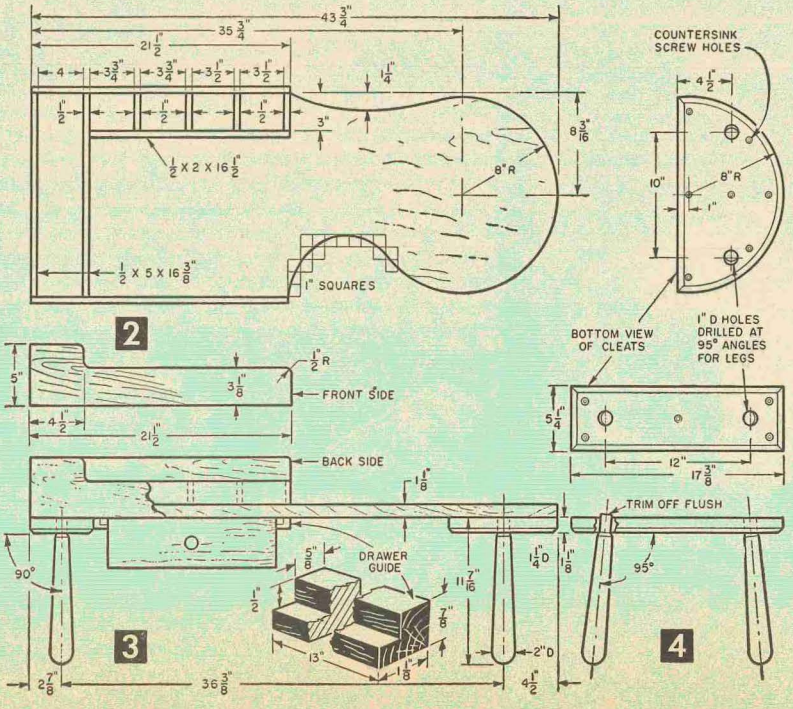


Cut the main plank (Fig. 2) from standard white pine screen stock, or spruce, which often comes as wide as 17½ in. If maple is used, it will probably have to be glued. Pine and spruce are sufficiently strong and durable for this project, except for the legs, which are maple, birch, or ash.

Sand only the curved edges of the top plank, since the others will be covered with the side and end pieces (Fig. 3). Cut these pieces, plus all materials for

MATERIALS LIST—COBBLER'S BENCH COFFEE TABLE

All dimensions in inches.
Material: pine or maple, with maple or birch legs.

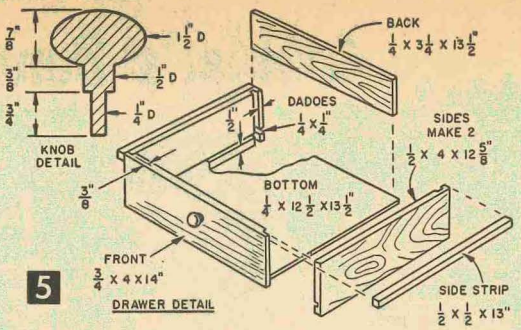
No.	Size	Use
1	1⅛ x 16⅜ x 43¼	bench proper
1	½ x 5 x 16⅜	end piece
1	½ x 3⅞ x 16⅜	end compartment piece
2	½ x 5 x 21½	side pieces
1	½ x 2 x 16½	inside compartment piece
4	½ x 2 x 3	compartment pieces
4	2 x 2 x 11 7/16	legs
1	1⅛ x 5¼ x 17⅜	cleat
1	1⅛ x 9 x 16	cleat
2	⅞ x 1⅛ x 13	drawer guides
2	½ x ½ x 13	drawer side strips
1	¾ x 4 x 14	drawer front
2	½ x 4 x 12⅝	drawer sides
1	¼ x 3¼ x 13½	drawer back piece
1	¼ x 12½ x 13½	drawer bottom
1	1½ x 1½ x 2	drawer knob

Screws, brads, wedges, glue, finish.

the various compartments, from ½-in. clear white pine (or maple).

Turn four legs to the dimensions shown (Fig. 3), including a 1 in. dia dowel end. Bevel all bottom edges of cleats approximately ⅜ in., the straight edges with a plane, the curved edges with a shaper, sander or rasp. Drill leg holes at a 95° angle to give a spread-out appearance when seen from the ends, but straight up and down when viewed from either side (Fig. 3).

Saw dowel end of each leg lengthwise to take a driven hardwood wedge after leg has been inserted into cleat (Fig. 4). Be sure the wedge tightens the leg insert with the grain, not across it, lest the bulging split the wood. Trim excess stock flush with cleat surface, then screw assembly onto bottom of bench by means of countersunk screw holes, making sure the beveled edges face downward.



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Next comes the drawer (Fig. 5). Cut ¼-in. dadoes ¼ in. deep and ½ in. up from bottom edge of both side pieces and front. Likewise cut dadoes at back end of side pieces for back piece. Rabbet both ends of front piece to take side pieces, which are glued and bradded on. Smear glue in dadoes and assemble with ¼-in. plywood used for bottom and back piece. Turn knob as shown, and glue ½-in. dowel end into drilled hole in drawer front.

Glue and brad ½-in. drawer strips to sides of drawer, and glue and screw rabbetted drawer guides (Fig. 3) to underside of main bench. These pieces support the drawer, and should be installed to allow a reasonably free drawer movement. If necessary, plane the outside edges of the drawer side strips.

With all exposed brad heads countersunk and holes plugged, sand entire assembly thoroughly, then stain, if desired, and apply finish, which can be shellac rubbed with oil, two coats of spar varnish rubbed with pumice and oil, or wax.

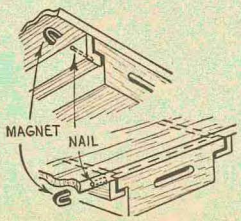
Small Parts Bin

• Cut away the top half or so of a dry milk pasteboard "can" and discard it. The remaining bottom half, with its metal bottom and sturdy sides, makes an ideal and handy bin in which to keep nuts, bolts, plugs, any such small parts.—F. A. J.

TV Saver Guard

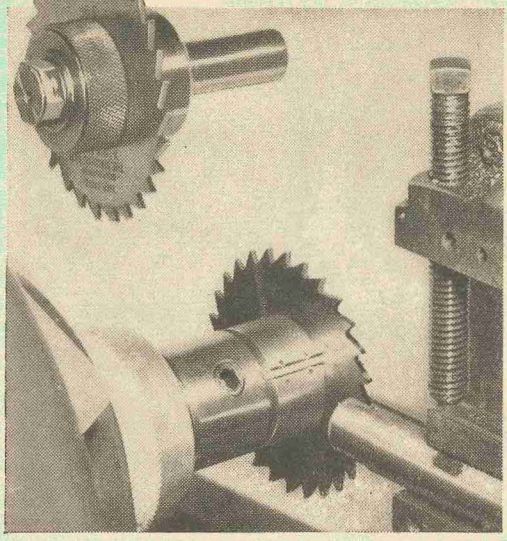
• Television set and the wall behind it get too hot? Could be because the set keeps getting pushed against the wall so that air can't circulate around it properly. Move the set away from the wall a few inches and note the position of the legs on the floor. At that point, tack down a length of ordinary half-round to keep set from being pushed up against the wall again. This will also keep back of picture tube from knocking wall.—F. A. J.

Drawer Lock



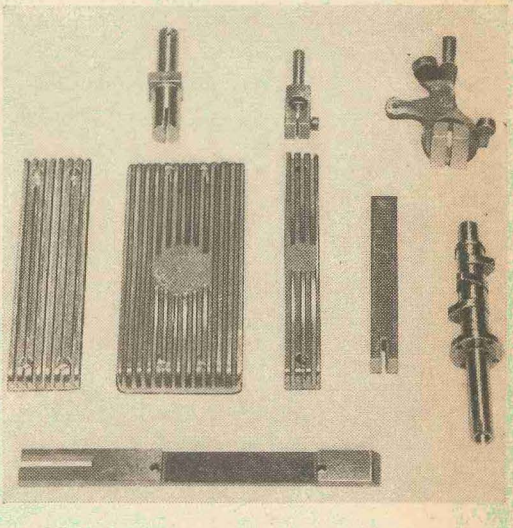
• A novel drawer lock which can be opened only with a magnet will baffle tool borrowers. Drill a hole into drawer support and drawer as shown. Insert a loose-fitting nail from which the head has been cut off. A small magnet will withdraw the nail —Ronald Eyrich.

Slitting Saw Arbor



MATERIALS LIST—SLITTING SAW ARBOR

No.	Size	Material
1	1¼" dia. x 3½"	cold rolled steel rod
1	1¼" dia. x 2"	cold rolled steel rod
1	⅛ x ⅜ x 1"	flat key stock
1	⅜-24 x ½"	cap screw



CUTTING accurate slots in small rods, bar stock or tubing or cutting keyways in shafts is simple with this arbor that mounts a slitting cutter in your metal working lathe. Work is held in a milling attachment for machine feeding and accurate cutting.

1. Chuck end of 1¼ x 3½-in. cold rolled steel in 3-jaw chuck and center drill for tailstock center.

2. Turn end to exactly .500 in. (or to size that fits the hole in your end-mill arbor).

3. Remove tailstock support and cut body to exact length with cut-off tool.

4. Mill or file the ½-in. slot on the body extension for setscrew.

5. Mount the body in an end-mill arbor, secure with setscrew and machine outer end of body to exactly .875 in.—the diameter of hole in saw. Take light cuts as you bring it to size. Exact diameter size is necessary for a true running saw. If an end-mill arbor is not available, machine the entire body between centers.

6. Drill size Q and tap ⅜-24 x ½ in. deep.

7. Remove body from arbor, lay out ⅛-in. slot and saw, mill or file the slot. Cut key from flat stock. Fit key into slot and use center punch to stake it in place at large part of body.

8. File key to fit keyway in saw, so it slips onto body easily. Saw must seat all around against shoulder.

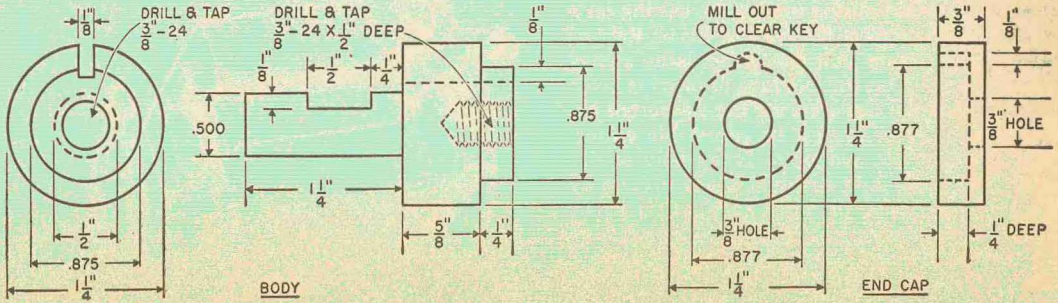
9. Chuck 1¼ x 2" steel stock in 3-jaw chuck leaving about 1 in. extending. True up end and knurl for appearance and for good finger grip.

10. Drill ⅜-in. hole through cap and bore out .877-in. diameter.

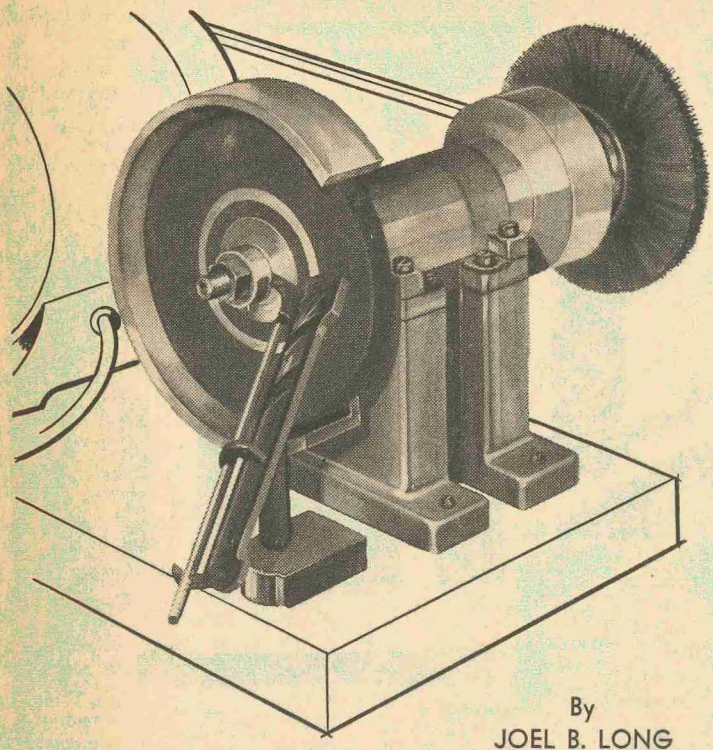
11. Cut off cap to length with cut-off tool.

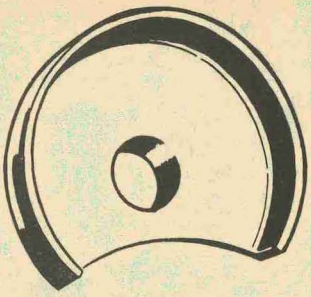
12. Mill out small section of wall to clear key.

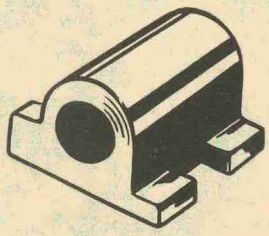
When using the slitting saw, hold the work tightly in the milling attachment; otherwise saw teeth may be damaged. When mounting saw, draw end cap tightly against saw with the cap screw.—JOEL P. LONG.

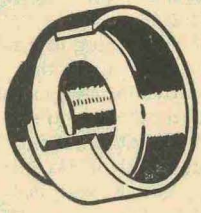


Rugged BENCH GRINDER





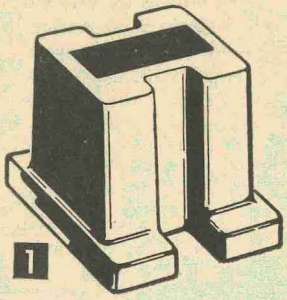


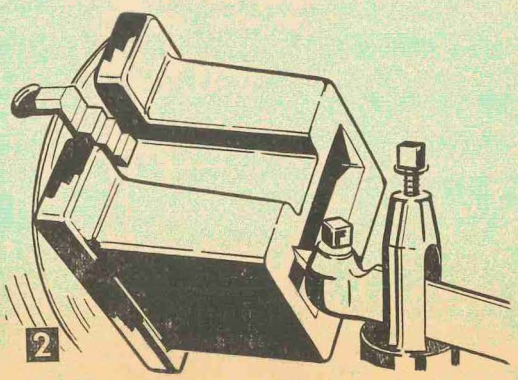


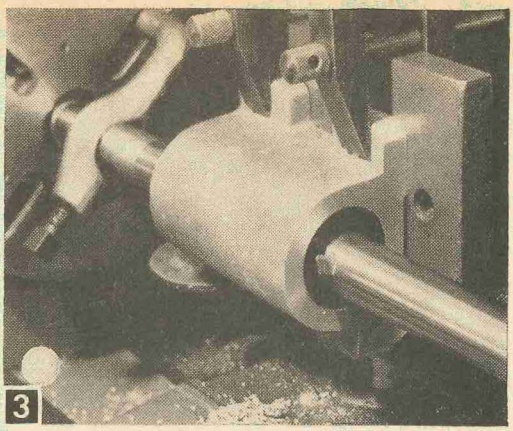
By
JOEL B. LONG

WITH this bench grinder you can keep your cutting tools sharp and do general offhand grinding, and can, with the aid of various attachments, perform such other operations as wire brushing, buffing, polishing, sanding, and drilling. Anyone having a bench lathe and drill press should have no trouble in building it. First, study drawings especially those showing the spindle assembly of the shaft and housing drawings (Parts #3 and 7).

Make up the patterns for the castings required, using measurements given on the prints. Cast base solid if you wish. Add about 1/16 in. for machining where facing is indicated on the print. Make frame and base of aluminum. The castings are shown in Fig. 1. Chuck the base (#8), in the 4-jaw chuck (Fig. 2) and take a facing cut across the top until smooth. Reverse casting and face the bottom. To bore out the frame (#1), that holds the spindle housing mount the casting on a home made angle plate fixture that fits on the tool post (Fig. 3). Note that the lower lathe swivel is turned around on the carriage to provide room to mount casting. Use a boring bar supported between centers and having an adjustable cutter; make, if one is not available. Bring hole to size (1.625) by taking light cuts and fine feeds and by adjusting the cutter bit after each cut is made. Remove from fixture and, holding casting in vise, carefully saw through its entire length with a hacksaw (Fig. 4). Drill the 2 holes shown with a



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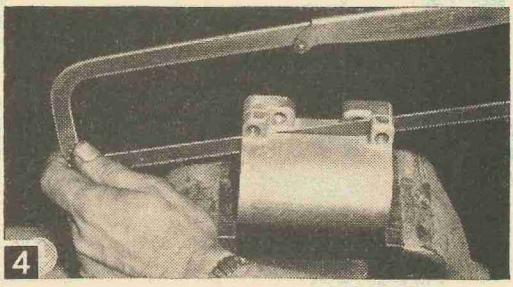
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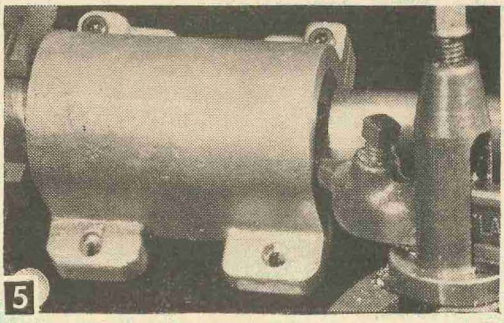
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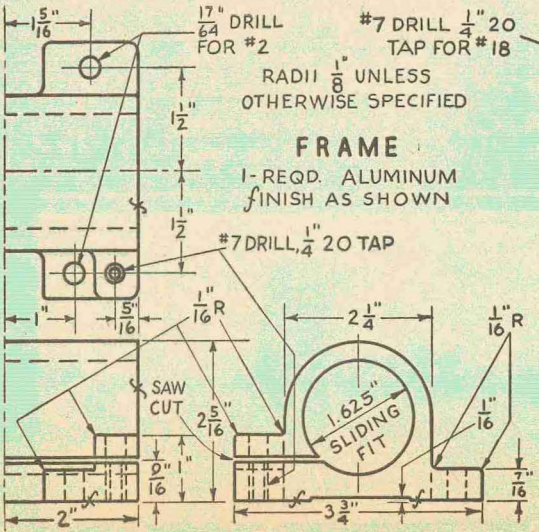
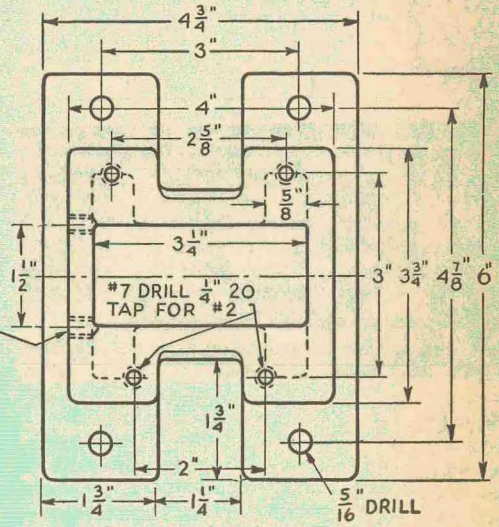
No. 7 drill and tap them ¼-20 *nc*. Turn a stub mandrel by chucking up a piece of scrap rod. Without removing from chuck, mount the frame on this and tighten the two screws which will hold it securely by closing the slot. Support outer end of mandrel with tail stock center. Now true up the ends and bring casting to 4 in. length (Fig. 5). Use the 3-jaw chuck to hold the belt guard casting (#10), with large part in. Take a light truing cut on the extension. Reverse the casting and chuck it by the extension. Face it to length (2½ in.) then bore out the hole (Fig. 6) to within .020. Use finished housing for a gage for a snug fit. Finish guard, bringing it to size. Machine the large wheel guard (#9), boring the hole to within .020 of the dia. After the inside of the large section is machined, mount the guard on a mandrel and true it up by taking a cut (Fig. 7). Drill holes with #7 drill and tap ¼-20 *nc*. for the set screws in both guards.

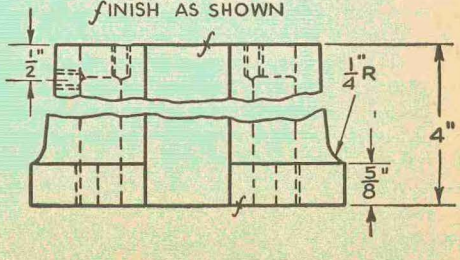
Build the tool rest (#15), and the bracket (#16). Mill clean slots in the bracket by holding it in the milling attachment and using a 5/16 in. mill end having 4 flutes, as shown in Fig. 8. Position frame on the base and drill and tap holes where shown for the 4 screws. Clean the frame and base with a file and fine emery cloth.

On the shaft (#7), be careful to get the exact measurements. Your finished job will be no better than the accuracy of the shaft assembly (Figs. 9 and 10). Use 1 in. dia. drill rod 12¼

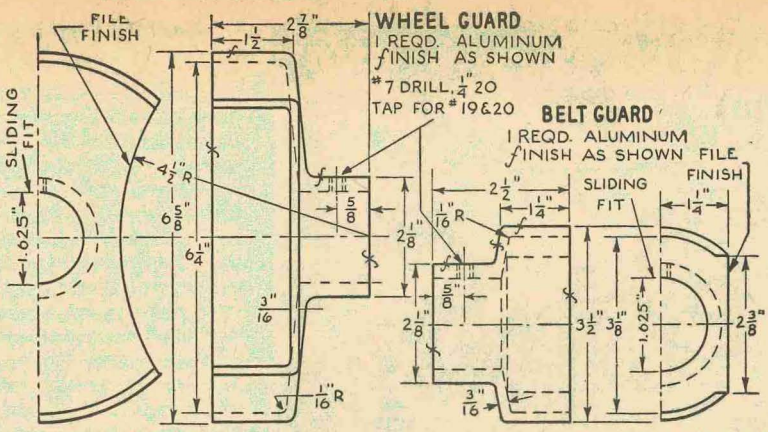


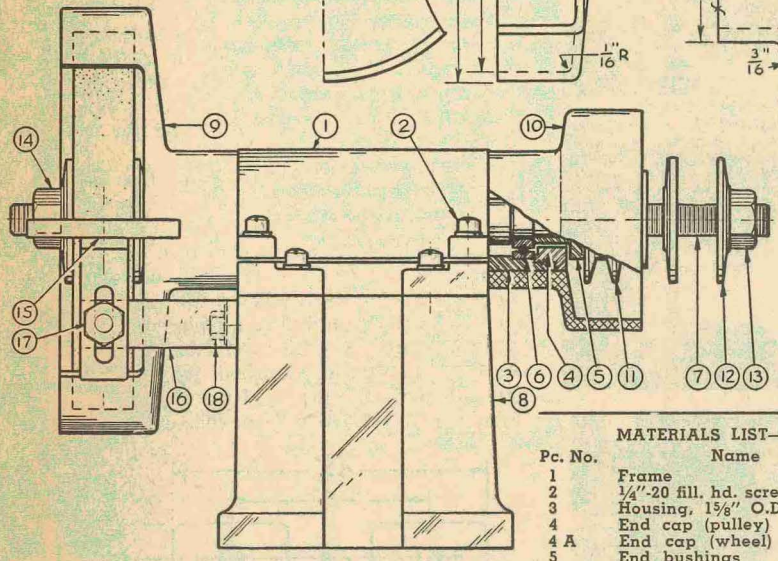


BASE ⑧
1-REQD. ALUMINUM
FINISH AS SHOWN



long for the spindle or a piece of cold rolled steel. Cut to length, center drill each end and mount between centers. Bring shaft to exact dimensions, getting an exact fit on the bearing surfaces. Use very light finishing cuts with a freshly honed cutter with slow feed. Use the bearing itself as a gage,



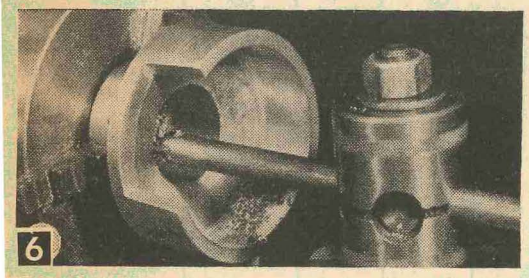


The finished shaft assembly is shown in Fig. 10.

Next, make the shaft housing (#3), to hold the sealed bearings. Chuck the tube in the 4-jaw chuck and center it dead true. Use a dial indicator if one is available, or center it by

MATERIALS LIST—6" BENCH GRINDER

Pc. No.	Name	Material	No. Reqd.
1	Frame	Alum.	1
2	¼"-20 fill. hd. screws, 1" lg	Steel	6
3	Housing, 1⅝" O.D., 1⅛" I.D.	"	1
4	End cap (pulley)	"	1
4 A	End cap (wheel)	"	1
5	End bushings	"	2
6	Ball bearings (77-3L02 N.D)	"	2
7	Shaft	"	1
8	Base	Alum.	1
9	Wheel guard	"	1
10	Belt guard	"	1
11	Pulley	Steel	1
12	Washers	"	4
13	½"-20 R. H. nut	"	1
14	½"-20 L. H. nut	"	1
15	Tool rest	"	1
16	Tool rest bracket	"	1
17	5/16" nut, bolt & washer (for #16 & #15)	"	1
18	¼" 20 hex. hd. screws ¾" lg. (for #8 & #16)	"	2
19	¼" 20 headless set screw (for #10)	"	1
20	¼" 20 headless set screw (for #9)	"	1
21	¼" 20 headless set screw (for #11)	"	1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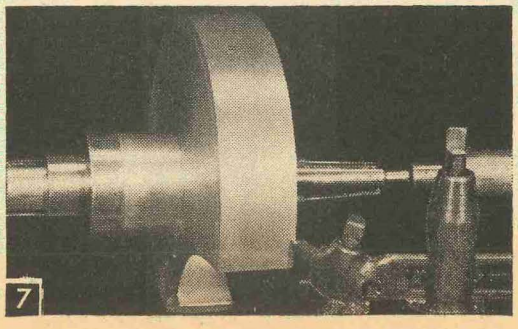
trying it for fit until you bring the bearing surfaces to exact size for a push fit.

Now, thread the ends. Be sure centers are true before you start. Cut right hand threads with carriage feed toward the headstock and compound set at an angle of 29° to the right as you face the lathe. Cut left hand threads with feed away from headstock and compound set 29° to the left. If your experience in screw thread cutting is limited, first consult your lathe manual on this operation and practice cutting some threads on a piece of scrap. In cutting the threads, grind a cutter bit to 60° angle or use a formed cutter (Fig. 9). Try the nuts for correct fit as you proceed. If you have a tool post grinder, grind the shaft all over and do a beautiful job.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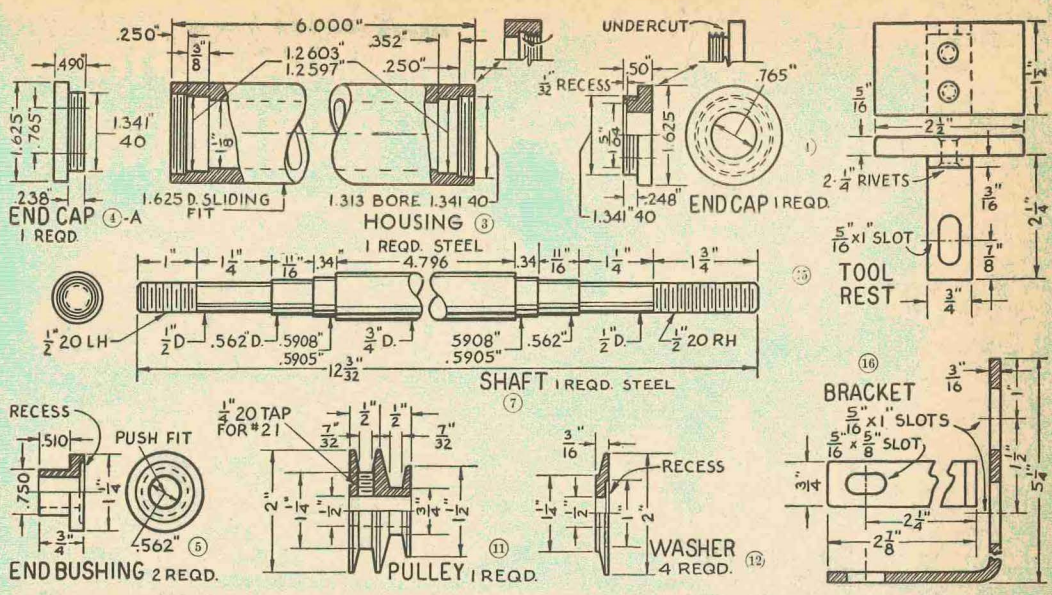
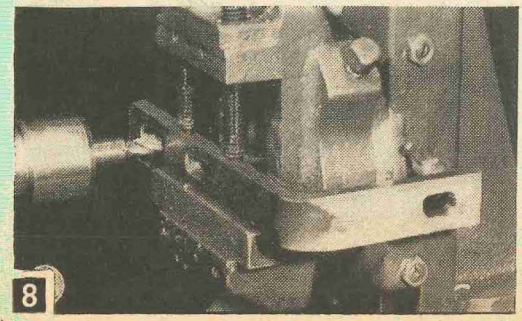


adjusting the jaws individually. After centering you will have a run out of a few thousandths on the free end, so with a very sharp cutter take a light cut and true up housing for about one in. (about .005 will be removed). This will give a true surface for your center rest to seat against. Now set up the center rest and then bore out the housing to dimensions given. As bearing recess must be an exact fit for the bearing use bearing as a gage until you get a push fit into recess. Next, face housing end true and smooth. Now thread the tube for the end cap. Transpose the gears to cut the internal threads 40 threads per inch and set the 60° cutter point on exact center. Use a heavy boring bar, then, to hold the cutter bit. Cut the threads to the correct depth given on thread gage or chart. Do not cut the threads without first making the undercut or groove as shown. This enables you to stop the cut without trouble. After threading one end, reverse the tube in chuck, take the truing-up cut as before and adjust center rest. Face end, bring tube to exact length, and then bore out tube or housing. Cut threads as outlined above.

Turn the end caps, Pt. 4, from solid bar stock or aluminum while held in the 3-jaw chuck.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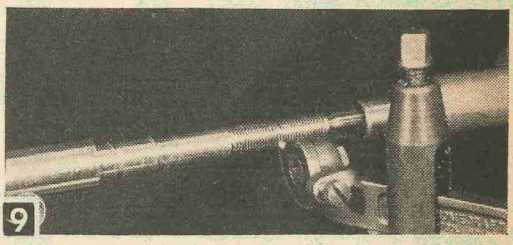
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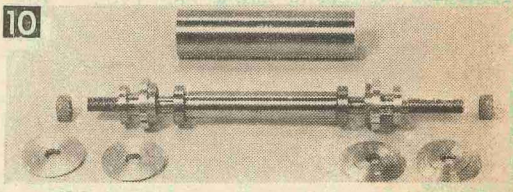
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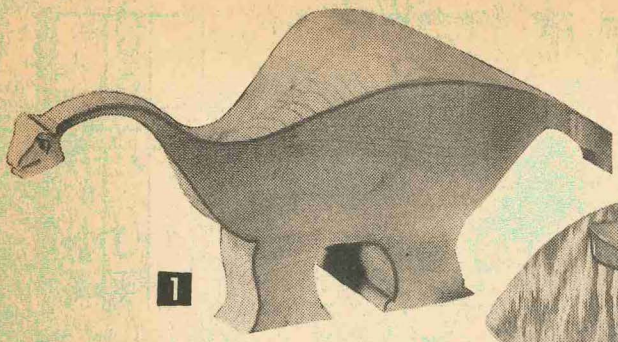
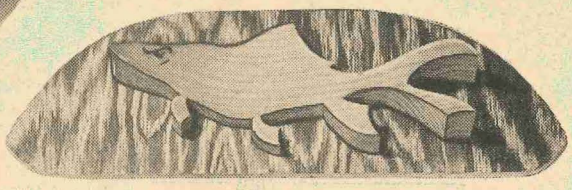
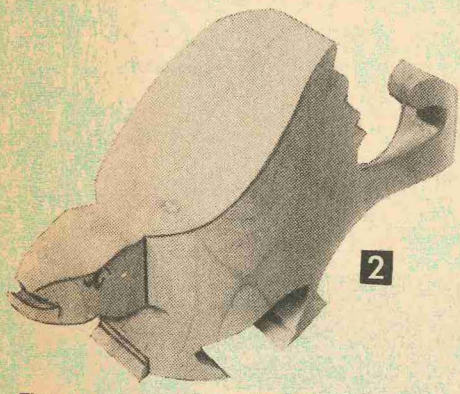
Finish to measurements shown, bore the hole and thread the end, bringing threads to proper depth. Use screw thread gage on threaded housing to try for fit as you go along. Complete the job, then cut off with the cut-off tool to exact length. Turn the end bushings (#5), the pulley (#11), and the washers (#12), from aluminum, steel or brass. With the shaft housing completed, re-chuck the large and small guards and finish boring the holes to correct size for a slide fit over the shaft housing. Use the housing as a gage for the hole diameter. Set screws will hold the guards securely on the housing.

Now for assembly. If you have followed the measurements closely, the shaft, when installed, should have no play or bind and should be free running. Drill 5/16 in. holes in base for the hold down screws or bolts. Also, drill and tap holes for screws that hold the tool rest bracket. Clean and polish base and frame and apply a coat or two of machinery enamel.

Whittling with a BANDSAW







Figures can be left to stand on their own (above) or mounted on contrasting wood plaques (as at right).

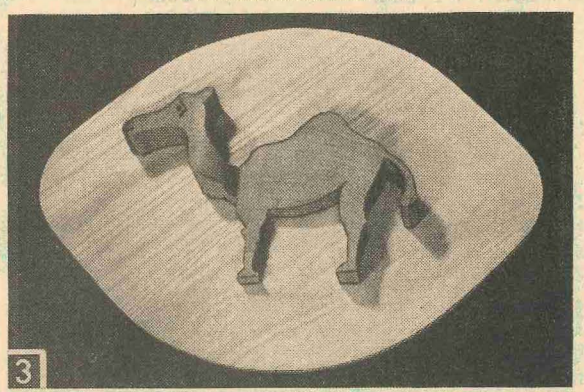
EVER wanted to be a sculptor? If you have a bandsaw or jigsaw, here's your opportunity to produce fascinating little figurines which you can display for pleasure or perhaps sell for money. The designs may be comical, stylized (Figs. 1, 2 and 3) or realistic—if you wish to add details by hand or with a small hand grinder.

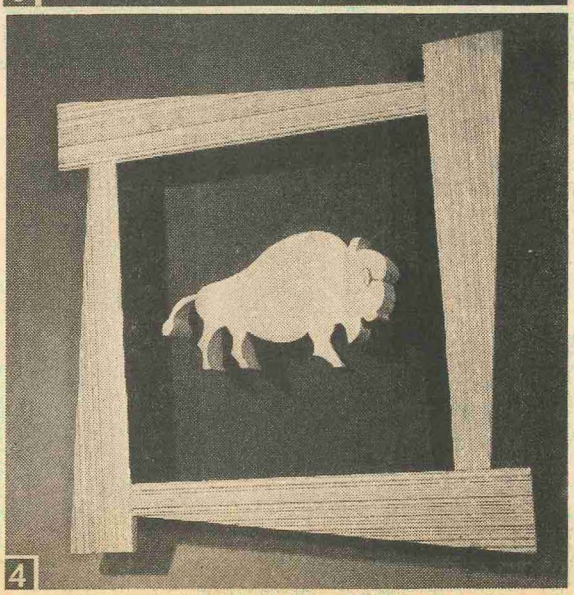
Keep profiles simple to minimize intricate cutting. Design the top profile so waste can be removed in two pieces.

You can use either solid blocks or save money by gluing together thinner scrap pieces. Contrasting woods will create special effects. Softer woods are easier to work; clear pine and walnut are good if you intend to finish with hand whittling. Dense woods such as birch or maple finish well but are more difficult to finish by hand carving.

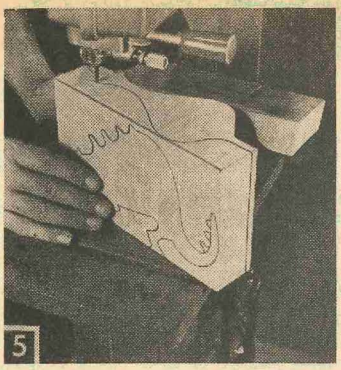
Average jigsaws have a 2-in. maximum capacity; home workshop bandsaws, a 6-in. capacity, so scale your figures so your machines will accommodate them. Figures shown were bandsawed.

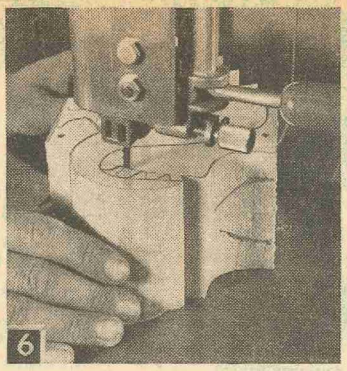
Use the smallest bandsaw blade available, ⅛ in. is good so long as you don't force the cut or feed the work too fast on tight turns; 5 or 6 in. is a deep cut for a ⅛-in. blade, so work carefully to prevent bowed cuts or broken blades. Heavier blades will





When mounted on plaques or in frames, the bandsawed figures make fine conversation pieces.



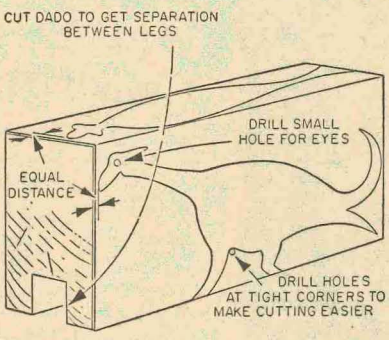


Left, When cutting top profile, remove waste in two pieces. Center, When cutting side profile, by-pass tight places and small nail-held areas, coming back to them later. Right, Brushing provides interesting effect.

not cut small contours readily. Occasional beeswax applications to the blade will help the work slide along.

To get to work, use rubber cement to nold the paper patterns to the wooden block. Line up the front end of the side view pattern with the front of the top profile (Fig. 8).

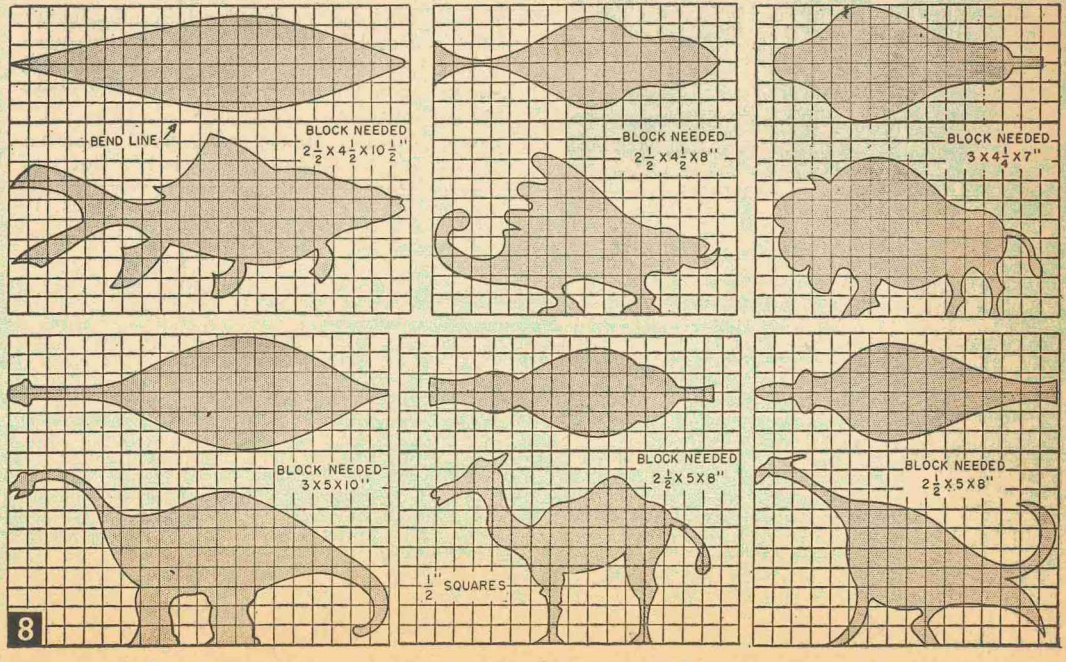
Some details can be added to figures before actual cutting begins. A dado formed down the center along the length of the block gives separation between the legs (Fig. 8); small holes for eyes and nostrils can be drilled. Drilled holes provide blade relief in tight corners; if of the proper size, the hole forms the corner without further cutting.

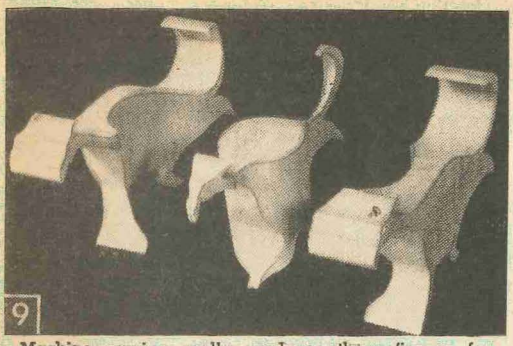


Cut out the top profile, working gently (Fig. 5) and removing the waste in two pieces. If you can't make a turn without cutting out, back up a bit and enlarge the cut enough to make the turn possible. Now, nail the sides back to regain a solid block, nailing in waste areas away from cutting lines.

Adjust the machine guard to block thickness and cut out the side profile (Fig. 6). Cut away waste as needed on this more intricate profile, except for the two small nailed areas. By-pass tight places until later when most of the waste wood is gone. Lastly, cut away the nail-held areas and you'll have a main figure and two side pieces having the reverse contour (Fig. 9).

For a smooth appearance, (Figs. 1 and 2), sand carefully, using progressively finer grits





Machine sawing really produces three figures for you—the control one and two reverse contours which may also be usable.

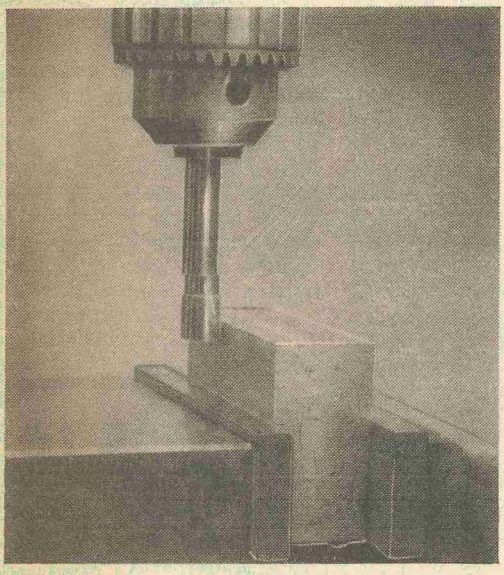
to smooth the finish left by the saw. Apply sealer, then smooth with fine steel wool.

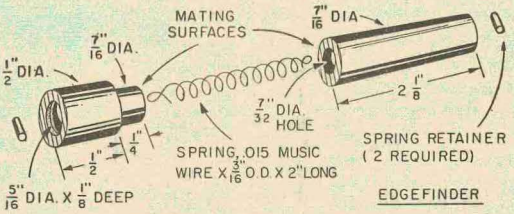
Figures can be flocked, painted or wire brushed (Fig. 7). Wear goggles when wire brushing to protect eyes from steel slivers. Hold work firmly; working across the grain to remove material quickly, *with* the grain to smooth the surface.

A quick-drying plastic sealer-undercoater-finish, such as *Deft* requires two coats with light steel-wooling between and paste wax application, and produces a hard glossy finish.

The two waste pieces resulting after the side profile is cut may be used in their present form after finishing. Or, they may be glued to a backing for mounting as a plaque or in a frame (Figs. 3 and 4).—R. J. DeCristoforo.

Edgefinder for Accurate Machining





MATERIALS LIST—EDGEFINDER

Amount	Description
3"	1/2" dia. ground & polished drill rod
12"	.015" music wire
2 pcs	5/16" long x 16 ga. steel wire

WITH this edgefinder chucked in your milling machine or drill press equipped with milling table, the center of the machine spindle can be quickly and accurately placed over the work edge, providing a starting point for drilling or milling at a precise distance from the edge. With normal care in machining, the accuracy of the tool is within .001 of an inch.

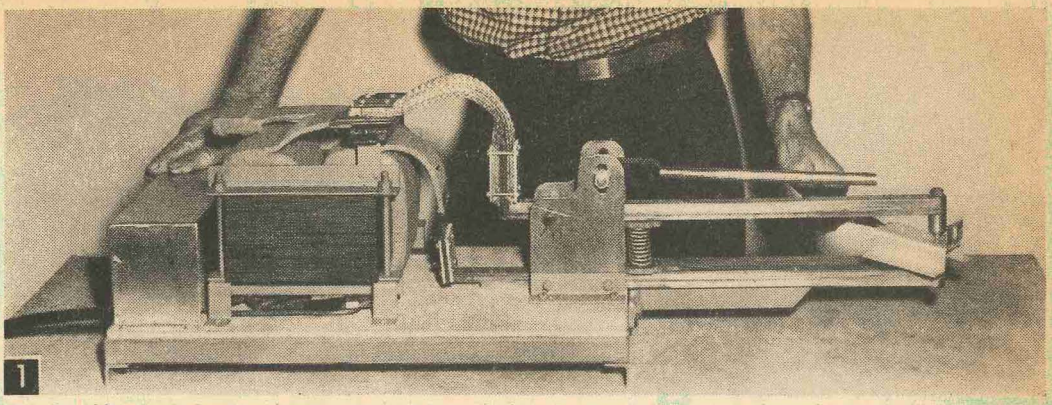
Chuck a ½ in. dia. x 3-in. piece of ground and polished drill rod in a lathe and center drill both ends. Turn the shank end of the rod to 7/16 in. dia. x 2½ in. as shown in the drawing, using the tailstock center for support. With cutting oil and moderate, constant pressure, drill a 7/32-in. dia. hole through the length of the rod. Drill two end holes 5/16 in. in dia. x ⅛ in. deep. Cut the drill rod in two at the ¾-in. mark (from the ½-in. dia. end) and take light facing cuts on both pieces.

Using a drill pad or other support in the tailstock, place a piece of 400A carborundum paper on the pad and lap the mating surfaces square and flat by chucking the pieces and bringing them into contact with the paper at low speed and light pressure.

From a .015-in. music wire, wind a spring 3/16 in. dia. x 2 in. long on the lathe. Cut two 5/16-in. lengths of stiff wire for the spring retainers. Wipe lapped surfaces clean and assemble edgefinder, using a music wire hook to stretch spring until retainers are slipped in place.

To use the tool, chuck it in the milling machine. Move the bottom part of edgefinder 1/32 in. out of line with the shank as in the photo. With the work clamped in a mill vise, move the mill table until the edge of the work to be located is within 1/16 in. of the edgefinder. Turn the machine on using 1000 *rpm* or less and slowly bring the work into contact with the rotating tool until the bottom piece of the edgefinder snaps into line and runs true to the shank. Do not move the table past this point.

The centerline of the finder is now .250 in. from the edge of the work. To center the spindle over the edge, move the mill table .250 in. in the required direction.—Norman Fried.



Spot welding two sheet steel parts. Current is applied and shut off while parts are under pressure, which eliminates burning of metal and results in clean welds.

SHOP BENCH

SPOT WELDER

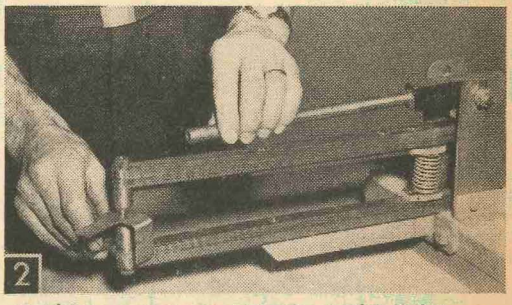
By HAROLD P. STRAND

A SMALL spot welder makes a quick, permanent bond without rivets or bolts —saving the metalworker considerable time and work.

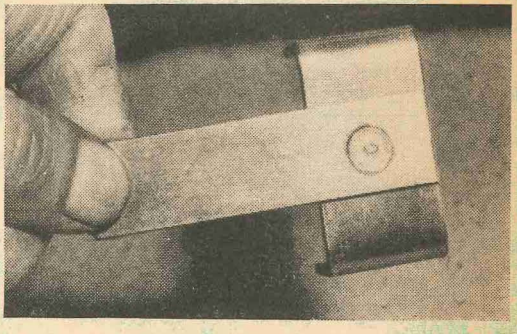
This welder, small enough to be portable, will join together sheet steel and parts up to about 3/32-in. thick. It will operate on 115 volts, 60 cycles, through an outlet wired with #10 wire and fused 30 amperes. Contact with the line is but momentary—a few seconds at the most—so we found that a 30-ampere fuse would hold. You can also provide connections for 230 volts, which draw less line current, by using the additional primary turns mentioned later plus a 230-volt relay and a push switch in place of the 115-volt equipment shown.

To spot weld, you must pass a very high current at low voltage through the parts to be joined, let's say 1,500 to 2,000 amperes at 3 volts. This high current produces white heat almost instantly in a small circle on work which is pressure-clamped between two copper electrodes (Fig. 2). When the heating occurs, the metal melts and the pressure forces it together to make a permanently fused joint (Figs. 3 and 4).

The transformer must be of heavy construction with large conductors capable of

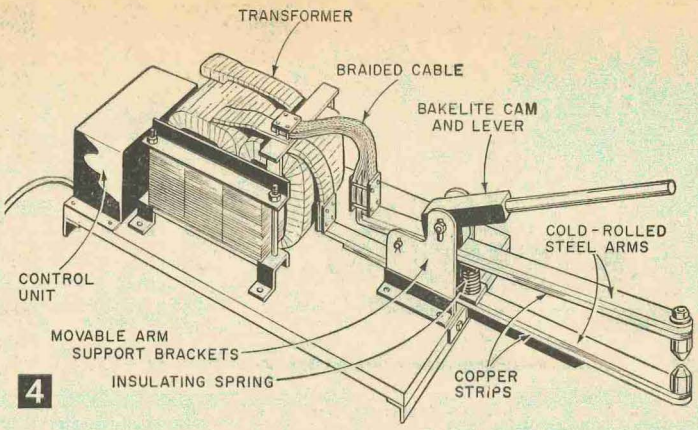


Applying pressure to two pieces placed between electrodes, prior to welding. Fig. 3 shows results of weld.

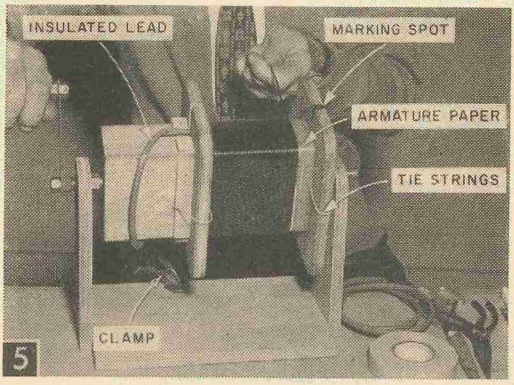


Both sides of neat weld joining the parts shown in Fig. 2.

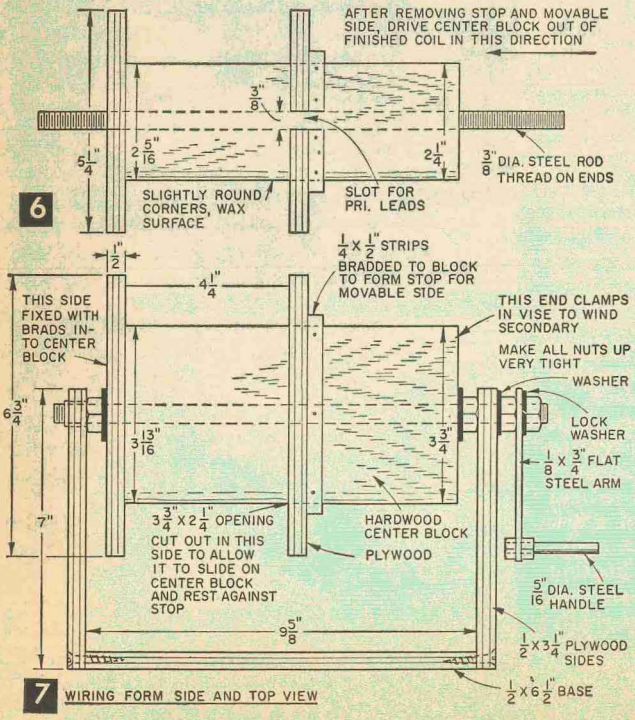
carrying the high current. The secondary winding, which furnishes the welding current, consists of nine strips of flat sheet copper, laid together and taped. The primary consists of #12 Formvar magnet wire. In order to keep flux leakage to a minimum and thus provide as efficient a transformer as possible, the winding is done on two coils (half the winding on each) which are joined together in series. This design provides the necessary voltage regulation, since the welding method is virtually a short-circuit on the transformer, except for the small resistance represented by the steel pieces between the electrodes.



Don't attempt to weld brass, aluminum or other low resistance metals on this unit; it is strictly a welder for all kinds of steel up to 3/32-in. capacity in thickness. I have actually welded material up to ⅛-in. thickness (two pieces of ⅛ in. placed together) with it, but it is a little beyond the capacity of this small unit and you may blow the fuse. For thin material, you need only a momentary contact, but use up to two or three seconds for heavier stock. Never keep the current applied over four or five seconds at the most.



Hand-winding coil on form detailed in Fig. 6. Insulated tubing covers start, tap and end of windings.



The necessary pressure is applied to the work with a lever which operates a Bakelite cam which presses down hard on the top or movable arm (Fig. 2). You can adjust this pressure by using the slotted holes at the cam shaft. After the work is clamped, you press a pushbutton on the control end of the unit; this pulls in a relay which connects the line to the transformer primary. Thus current is turned on and off *after* the work has been tightly clamped, insuring a minimum of burning and pitting.

The core of the transformer is made from pieces of black stove pipe iron, which is more easily obtainable than standard transformer silicon steel, and for intermittent duty works about as well.

Make Up the Winding Form from ½ in. plywood with a hardwood center block as in Figs. 5 and 6. A coat of wax, plus the

MATERIALS LIST—SPOT WELDER

Base

No. Req'd.	Size and Description
1 pc	hardwood 1¼ x 11 x 21½" (oak, birch, maple, hard pine, etc.)
2 pcs	angle iron ⅛ x 1 x 11" (under base)
1 pc	transite asbestos-cement board ¼ x 11 x 21½" (top)

Transformer

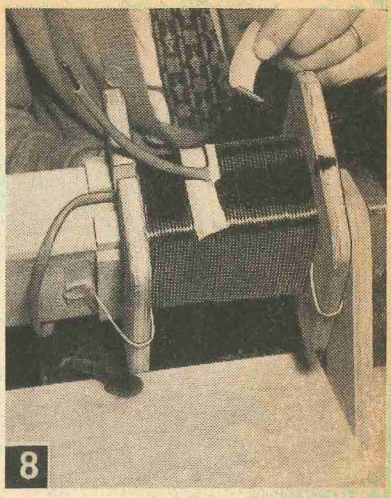
	Approx. 42 pounds of 28-gage black stove pipe sheet iron cut into 2" wide strips (core)
	Approx. 8 pounds of #12 Formvar magnet wire (primary)
6 pcs	12 x 32" sheet roofing copper about .020-.022 thickness (secondary)
6 pcs	copper 1/16 x ¾ x 24½" (conductors to electrode, lower arm)
6 pcs	copper 1/16 x ¾ x 22½" (conductors to electrode, upper arm)
2 pcs	copper rod stock ⅜" dia. 2¼" long (electrodes)
4 pcs	angle iron ⅛ x 1 x 8" (core clamps)
4 pcs	cr (cold-rolled) steel rod stock 5/16" dia. 5" long. Thread ends 5/16"-18 for a distance of 1½" (core clamps)
4 pcs	cr steel 1/16 x 1" x approx. 3½"
1 pc	Bakelite ¼ x 1¾ x 7½" (terminal strip top of trans.)
2	rolls white cotton coil tape 1" wide and .007" thick
8	hex nuts, 5/16"-18, and washers
Brass:	2 pcs. ⅛ x 1½ x 2¼"; 1 pc. ⅛ x 1⅝ x 1⅞"; 1 pc. ⅛ x 1⅞ x 1⅞"; 1 pc ⅛ x 1 x 1⅞" (for terminal clamps)
6	auto battery braided ground straps, 1" wide heavy type, about 11" long of flat cable, with lugs on ends removed
Misc.:	1½" wide Mystik cloth adhesive tape; Bakelite pcs for coil wedges; 10-32 brass screws and nuts for terminals; insulating varnish; 6-ft spaghetti tubing 3/16" O.D.; .010 armature paper

Control Box

1	heavy duty relay D.P.S.T. or D.P.D.T. contacts rated 30 amp., 115 volt A.C. coil (or 230 volts for 230 volt operation). Struthers-Dunn #8BXX or old number, possibly surplus, ADBT8 (115 volt coil). Apparatus Service Co., 355 Everett Street, Allston 34, Mass., has #8BXX D.P.S.T. Could use other make of relay with same specs.
1	momentary-contact push switch, normally off (Arrow H & H type 3391-GL, rated 1 amp, 125 volts. For longer service or for 230 volts, use a switch of higher rating. Must be momentary contact, normally off type.
1	barrier type terminal strip, Jones Type 3-141
7 ft	#12-2 wire rubber cord
1	20-ampere polarized cord plug, 2-pole. For 230 volts, use a 3-pole plug and 3-wire cord, with third wire grounding the transformer
1 pc	alum. 3/32 x 3¾ x 4⅝" (switch panel)
1 pc	alum. 1/16 x 4¼ x 4½" (piece back of panel)
1 pc	alum. approx. .024 x 14 x 9" (cover). Or use 24-ga. galv. iron
	Sheet metal screws, wood screws, #12 hook-up wire, #18 hook-up wire, terminal lugs

Welder Arms and Misc.

1 pc	cr (cold rolled) steel 5/16 x ¾ x 20" (lower arm)
1 pc	cr steel 5/16 x ¾ x 18¾" (upper arm)
2 pcs	angle iron ⅛ x 1 x 4" (supports for bottom of side plates)
2 pcs	cr steel ⅛ x 4 x 6" (side plates)
1 pc	cr steel ⅜" dia. 3¼" long (welds to upper arm)
1 pc	cr steel ⅜" dia. 3½" long (cam assembly shaft)
1 pc	cr steel ¼ x ¾ x 11/16" (stop for cam)
1 pc	canvas-type Bakelite ¾ x 1⅞ x 2¾" (cam)
1 pc	iron pipe ¼" pipe size, 11" long (pressure handle)
2 pcs	Bakelite ¼ x 1¼ x 1⅝" (compression spring seats)
1	compression spring, 12 turns, 1" O.D. about 3/32" dia. spring wire
1 pc	cr steel 1/16 x 1" x approx. 3" (term. strip brackets)
1 pc	cr steel ¼ x 1 x 7½" (brace under lower arm)
1 pc	cr steel ¼ x 1¼ x 4" (brace under lower arm)
2	lag screws ⅜ x 3" (brace under lower arm)
4	⅜" hex nuts (cam shaft)
2	5/16"—18 hex nuts (electrodes)
2	*fh* machine screws ¼"-20 x 2¼" (lower arm to base)
4	*rh* machine screws ¼"-20 x 2" (arm bracket assembly to base)
6	¼"-20 nuts and washers
4	10-24 *rh* machine screws 2" long (transformer to base)
2 pcs	pipe or tubing, brass or steel ⅜" I.D. ⅝" O.D. ¾" long (arm shaft spacers)
2 pcs	same as above, ⅜" long (cam shaft spacers)
	Misc. nuts, screws, washers, etc.



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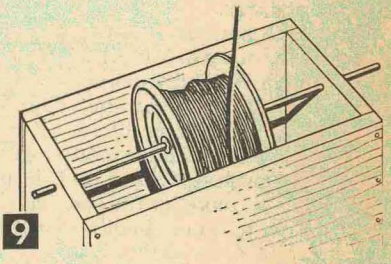
To make tap for 115-volt operation at the 80th turn, bring out a loop of wire, slip tubing over it, and use some adhesive tape both under and on top of the point where the wire is brought out.



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slight taper to the block, enables you to press it out of the coil later when wound. Make up the nuts very tightly so the form will not slip on the shaft and the crank will be tight.

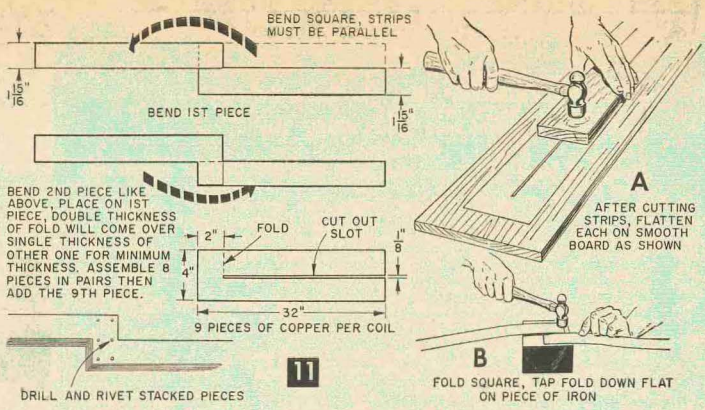
Place two turns of .010 in. armature paper tightly around the block with lengths of strong string or cord at each of the two flats of the block under the paper. Keep free ends of strings out of the way by taping them over to outside of the form sides. These strings will be used to tie up the coil when wound. Be sure armature paper comes fully up to the form sides.

Make the start end of the #12 wire about 10 in. long as a lead. Cover this lead with a piece of spaghetti insulating tubing which is then placed in the slot and wrapped around the block.

Wind the turns on evenly and smoothly with each one close together (use a piece of wood to tap them down snug and flat if you wish). Keep a careful count of the number of turns. Note the marking spot of black paint on the form side oposite the slot (Fig. 5); each time this spot comes up is one turn. Note your count down on paper occasionally to avoid an error.

For 115 volts, put 80 turns on each of the two required coils. If the welder is to operate on 230 volts, you can bring out a loop of wire at the 80th turn, equipping the looped lead with tubing for insulation as in Fig. 8, and then continue on to 160 turns, where the end is brought out. This gives you a tap for use on 115 volts in case you want it. Re-

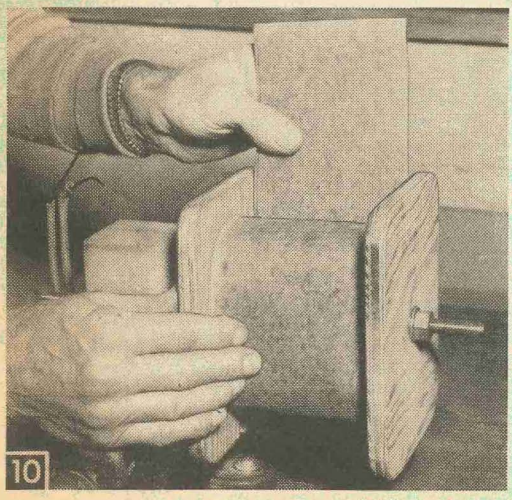
member, though, that the coil will be larger than if you wind it for 115 volts only, and it may be necessary to alter the dimensions of the core to suit; this can be determined later. In making this tap, place adhesive tape under the tap for added insulation and then a second piece of tape over it to hold in place. Mark the start end of the winding (S), the tap (80) and the end (160) by placing white adhesive tape on the leads and marking with a pencil.



Support your reel of wire under the bench during winding as in Fig. 9. It will take around four pounds of wire if you put 160 turns on each coil, and it is well to have a little extra to make sure. Make no splices in the winding, except that an end could be made at the 80-turn tap instead of having a loop, soldering the ends together at this point later.

When the primary coil has been wound to the correct number of turns, use the strings to tie up the coil tightly on each side. Remove the base and crank of the winding jig and then clamp the center block in a large vise. Place two turns of the armature paper tightly around the primary coil as in Fig. 10. You are now ready to make up the secondary winding, which is made up of sheet copper strips (Fig. 11).

Cut the sheet roofing coppper into 4 in. wide strips, each 32 in. long to make sure that the leads or ends will be long enough to reach their terminals. Make a ⅛-in. wide slot down the exact center of each strip, to a point 2 in. from the other end. Then flatten each slotted strip on a smooth board, using a piece of wood and a hammer (A in Fig. 11). Make up nine pieces exactly alike for each of the two required coils, or 18 in all.



Two turns of armature paper, placed around completed primary winding, insulate it from secondary winding.

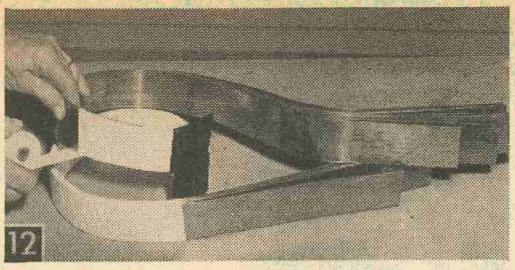
Next fold over each of the nine pieces as indicated in Fig. 11, and tap the folds down tightly (B in Fig. 11). These folds must be made square so that the two free ends running in opposite directions will be on a straight line with each other. The folds should also be made alternately (Fig. 11), so that a pair can be placed together with the double thickness of one fold coming over the single thickness of the previous piece when laid together. This keeps thickness of the assembled stack at a minimum. If in doubt, cut duplicate pieces from cardboard, and experiment.

Because the roofing copper comes in 12-in. width, you can obtain three 4-in. strips from each full width piece. Ask your hardware or building supply store for roofing copper about .020-.022 in. thick.

Lay the nine copper strips you have prepared together and use a small parallel clamp used to hold the center sections together. Then drill six holes through the pieces for small, low-headed copper rivets of about 1/16 in. diameter, and rivet down tightly. File off any burr the drill makes underneath, so the pieces can be drawn together tightly.

When shaping the winding to the curved form it will have when in place, keep the turns around the primary in the same direction as the primary winding. That is, when you look at the primary with the leads facing you, you'll note that the winding will go counter-clockwise if you turned the crank normally to the right, and the finish end will thus come around going to the left. When shaping the secondary winding, remember to curve it so that one end will follow the same to-the-left direction, which we will call the finish end of this winding.

Taping the Secondary Winding Strips. Insulate the center section of the secondary



Applying cotton coil tape around stacked strips.

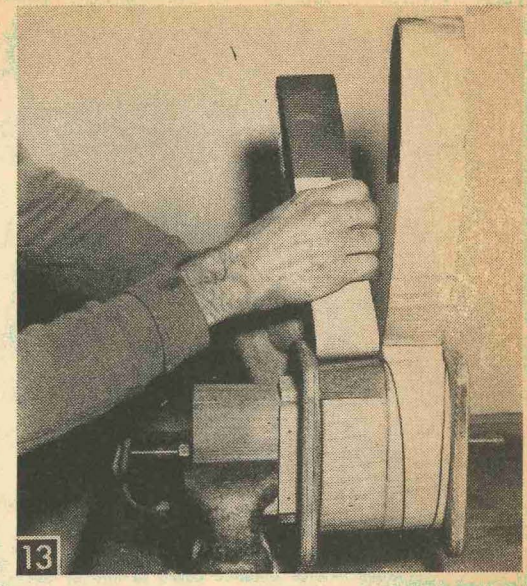
winding with two layers of a good cloth adhesive tape (such as 1½-in. wide Mystik cloth tape sold in stores for binding rug edges). Be sure to cover the edges as well as the flat surfaces. Then bind rest of strips to a point 6-8 inches from these free ends with white cotton coil tape as in Fig. 12, pulling the tape tightly and lapping about one half its width. This tape, sold by concerns dealing in winding supplies, comes in 1 in. width which is about right for this job. Bind the finish end with some adhesive tape. The taping is done with the conductor strips curved; if you tried to tape it flat, the plies would buckle when you wrapped the strips around the insulated primary.

Now shellac the prepared heavy conductor and hang up to dry for several hours. Then apply the secondary winding as in Fig. 13. With the primary leads at the bottom, the center section is placed on the top or the other narrow side with armature paper under it and secured with some adhesive tape. Carry one end tightly around to make one complete turn, ending up at the top, where a sharp bend is made and strong string is then used to tie it fixed. Then carry the other end around in the opposite direction to make another similar turn (Fig. 13).

Slip a piece of armature paper between the center section and where the two turns come around on top of it, to insure that there be no short-circuit there. In effect, this type of winding provides two turns, with both ends brought out as leads. Tap the winding down with a wood block and a light hammer as you place it in position and before tying; this helps shape the coil to the surface over which it fits. To provide some additional insulation between the two one-turn coils to prevent a short-circuit, pull several turns of heavy string or cord between them, to make a separation of about 1/16 in.

Note also in Fig. 13 how the secondary coil has been shaped with respect to the direction of the winding. With the primary leads facing you as shown and starting with the end held in the hand, note that the turns go around in a counter-clockwise rotation as they do in the primary, which is correct.

Figure 14 shows the coil being taped, after



Wrapping ends of secondary in opposite directions over the insulated primary windings.

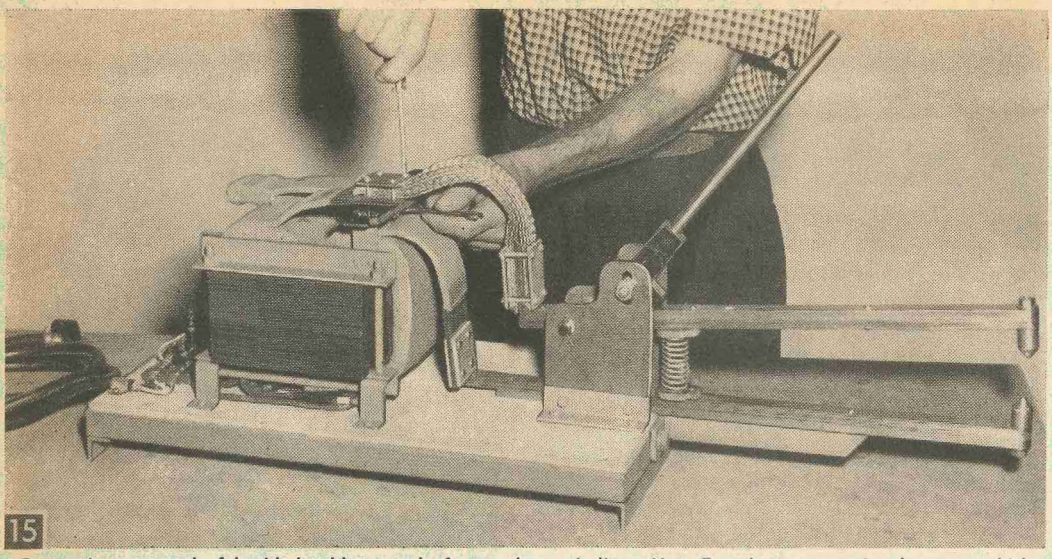
the winding form has been dismantled and the center block pressed out. Use a needle and thread to sew the tape tightly around the leads and also to hold the finish end.

Taping coil with 1-inch wide cotton tape pulled tightly and lapped for half its width.

The Second Coil. Re-assemble the form and make up another coil with both primary and secondary insulated exactly like the first one, and with the turns put on in the same direction. Then immerse the two taped coils completely in air-drying insulating varnish. Allow coils to remain about 20 minutes, then hang them up to drain, and let them dry in a warm place for about two days. This can be hastened by using infra-red lamps.

Or, if you have baking facilities, use baking varnish. Proceed the same way but bake the coils for about four hours at 250°F. or until the varnish has fully hardened.

The next step is the transformer core, which is assembled from black stove pipe sheet iron cut into strips. Temporarily place



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Connecting one end of braided cable to end of secondary winding. Note Transite top covering base on which welder is mounted.

the two completed coils in the positions they will have when assembled (Fig. 16), with about ¼-in. space between them.

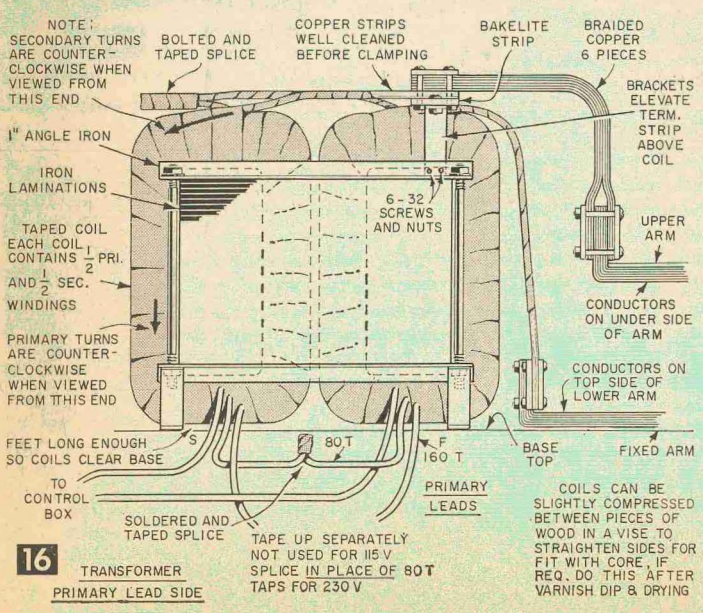
Now, for a test fitting, cut some cardboard pieces to the dimensions shown for the lamination in Fig. 17A. Place these test cardboard pieces through the coils; they should come through coils and meet properly as in Fig. 17. Note any increase in length required (coil sizes vary some depending on how tightly they have been wound).

While it is best to have the iron pieces cut to size on a power shear, to save costs ours were cut to 2-in. wide strips and about 24 in. lengths by a tinsmith. Then we rigged up a large paper cutter to cut them to length as in Fig. 17E. A step-stop screwed to the board allows strips to be cut squarely to uniform length, using one step for each of the two lengths.

Make up a stacking form or jig as shown in Fig. 17B, D and F. Cut and drill four pieces of ⅛ x 1-in. angle iron for the clamps and bend up and drill four pieces of 1/16-in. C.R. steel (Fig. 17F) for the feet. The feet and four 5/16-in. threaded rods are placed in the positions they will occupy and four wood screws used to secure the feet temporarily to the base. Two wood strips which match the height from the base to the angle irons are placed on the base to catch the ends of the first laminations.

Stacking is done by alternating the laminations so that the butt joints of one layer do not coincide with those of the next (Fig. 18). I found that stacking to 3⅝-in., and then placing a heavy iron weight and hand pressure on the laminations brought the stack height down to just over 3½-in. When compressed further by the angle iron clamps, stack height came down to the necessary 3½-in.

Attach the two top angle irons across the narrow ends



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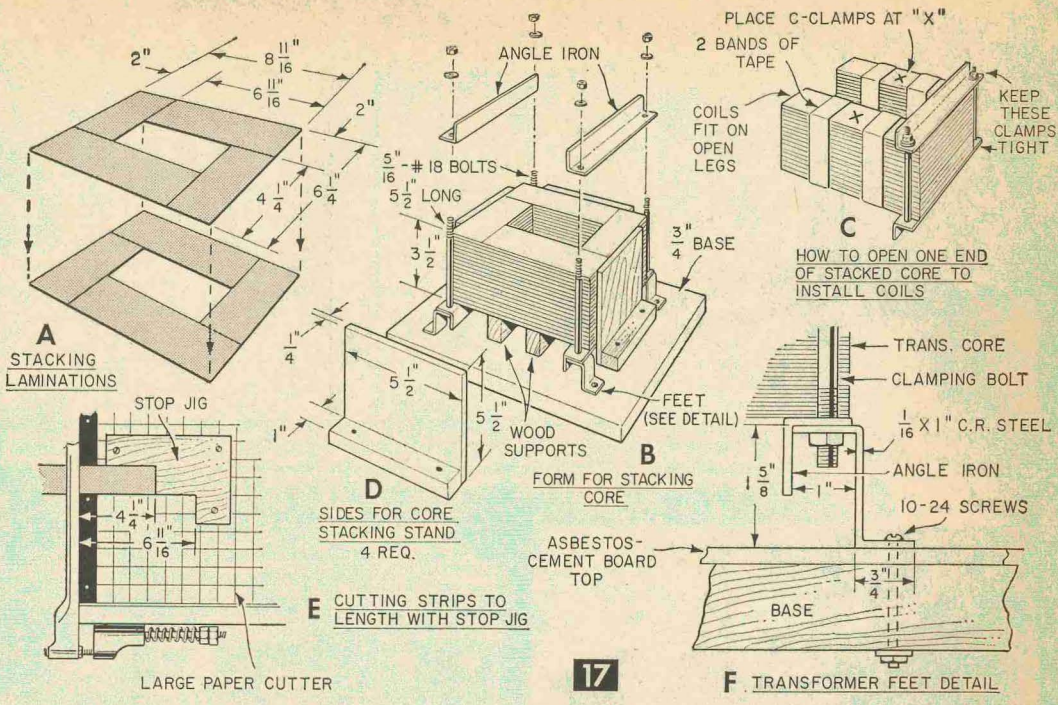


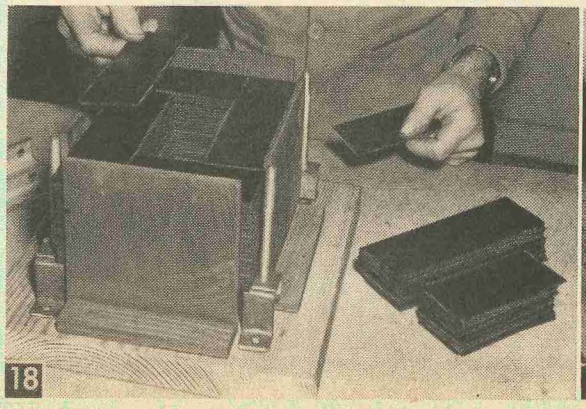
17

of the core, and compress by using the nuts on the rods. Tap the laminations (Fig. 19) to square up the stacking. Next place a large C-clamp at the center of one of the longer sides (see X in Fig. 17C). Apply four turns of friction tape as a tight band on each side of the clamp. Clamp and tape the opposite side (Fig. 17C) and you can then remove the angle iron on one end. Carefully remove the lamination from this unclamped end; this provides two open legs of the core upon which the coils can be placed.

Wrap two turns of armature paper around the open legs, securing the ends with cellophane tape. Next place a piece of ⅛-in. Bakelite down on the core in the space between the two legs. Fit the first coil over one of the legs, allowing it to rest against the Bakelite piece. Fit the other coil over the other leg, with the leads facing the same way as the first (Fig. 20). The coils should press down over the insulated legs snugly. To wedge coils in place cut some 1½ x 3½-in. Bakelite pieces about 1/16 in. and ⅛ in. thick, and drive them between the core insulation and the coils at the narrow or lead ends, without distorting the coil shape too much.

Now carefully replace the removed laminations, as in Fig. 16, weaving them in (Fig. 21), with joints butting, never overlapping.

With the transformer completely assembled, the two ends of the secondary are cut



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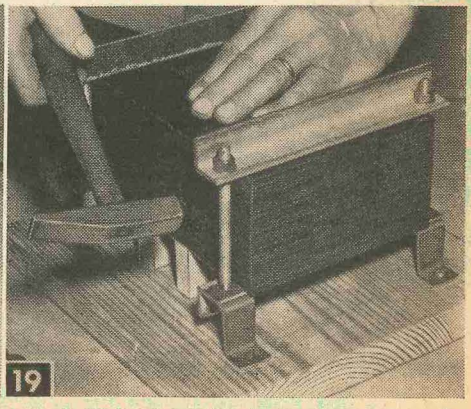
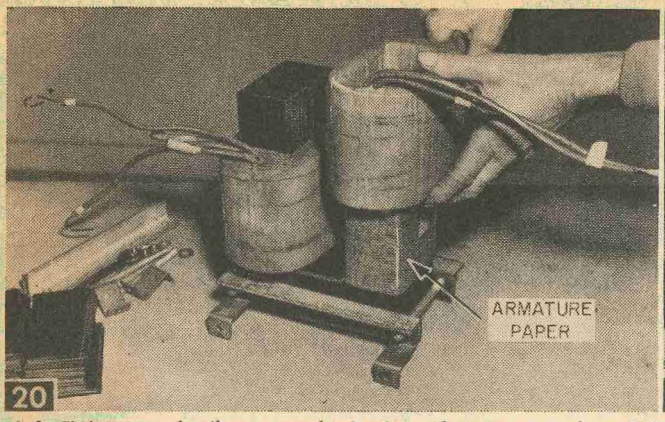
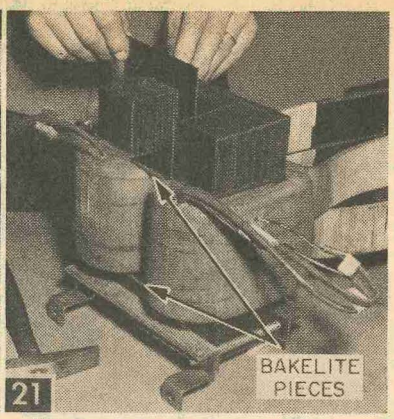


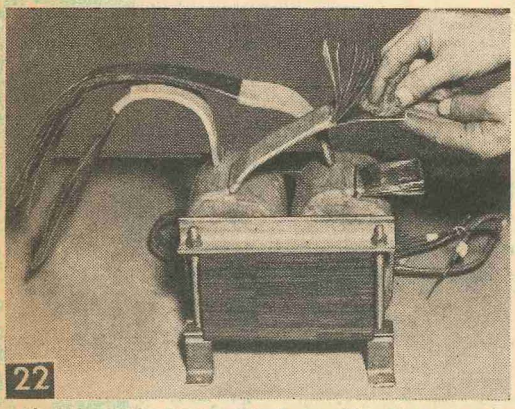
19

Left, Core laminations are stacked in alternate positions so the joints of successive layers do not coincide. All joints butt; there is no overlapping. Right, After clamping, laminations are tapped to true up stacking square.





Left, Fitting second coil over core laminations. If necessary to keep ¼-in. clearance between the two coils, compress them slightly between pieces of wood in a vise. Right, Replacing the laminations which were removed to provide an open end over which coils could be fitted.

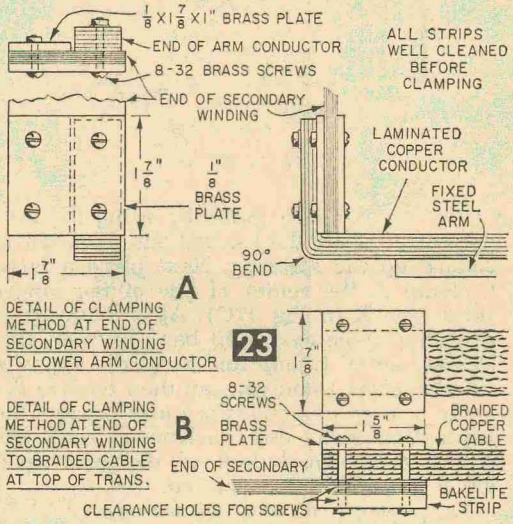


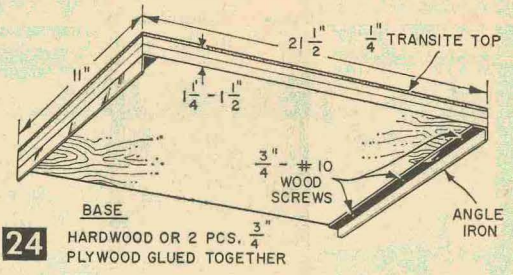
Cleaning each copper strip thoroughly prior to connecting.

off so they will meet in a joint with about a 2-in. lap (Fig. 22). Next make two 1⅞ x 1⅞-in. clamping plates as in Fig. 23A. Place one plate on top of the lapped joint and the other under it lining up the holes; then apply a small clamp. Using a #11 drill, make four holes through the copper, using the plate holes as a template, and a wood piece underneath to prevent coil damage. Clamp the joint with four 10-32 brass roundhead screws and nuts. Insulate the joint with 1½-in. wide Mystik cloth adhesive tape.

The Spot Welder Base is made from a dry, flat 1¼ or 1½-in. thick piece of hard pine or two pieces of ¾-in. plywood glued together, as in Fig. 24. It has a top surface of ¼-in. asbestos-cement board (Transite). The two 1-in. angle iron "legs" keep the board from warping and also provide finger-room for lifting the unit.

The welder arms are made from strips of ¾ x 5/16-in. cold-rolled steel (Fig. 25). A piece of ¾-in. dia. steel rod stock welded to the top or movable arm forms an operating shaft; this welding can be done in a local welding shop.

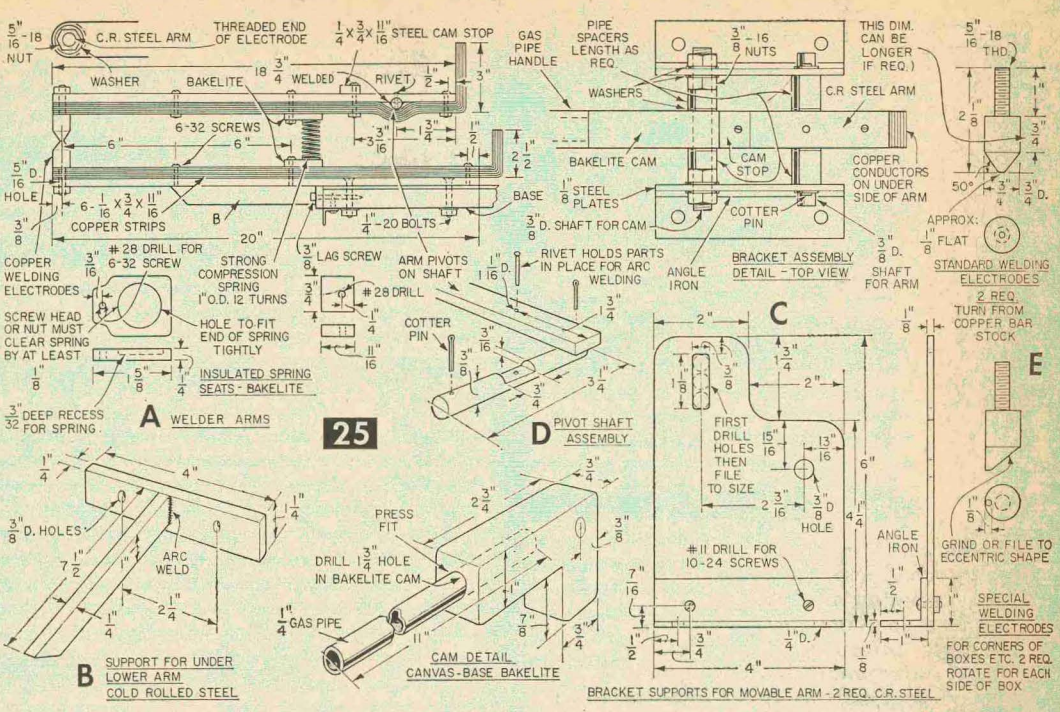




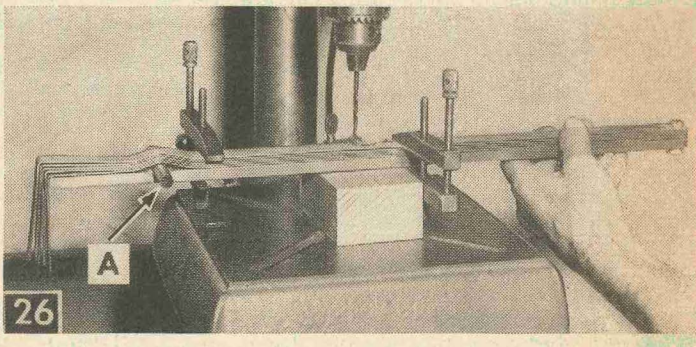
The six strips of 1/16 x ¾-in. copper attached to each arm (Fig. 26) act as conductors to the welding tips.

The steel lower arm is first attached to the base with the screw holes made and tapped in advance, so the copper strips can then be attached easily (Fig. 25A). The screws in the lower arm are used in tapped holes; those in the upper arm use nuts as shown.

Turn the welding electrodes or tips from



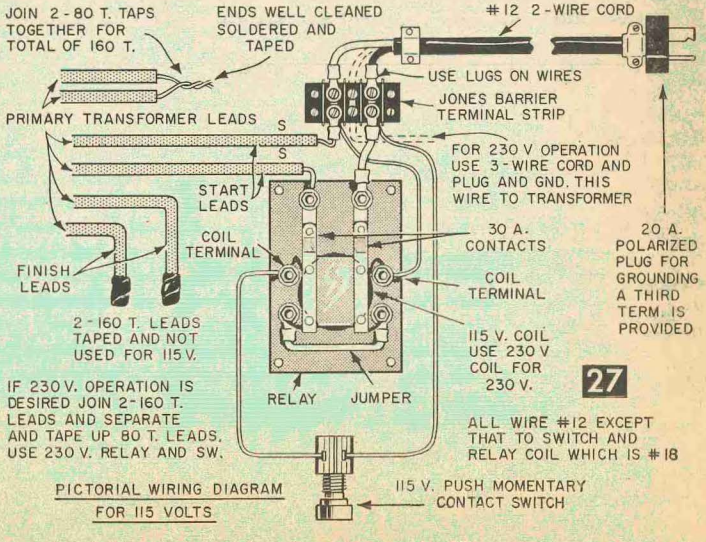
Attaching copper strip conductors to steel arms. Note steel pivot rod (A) already welded to top arm.

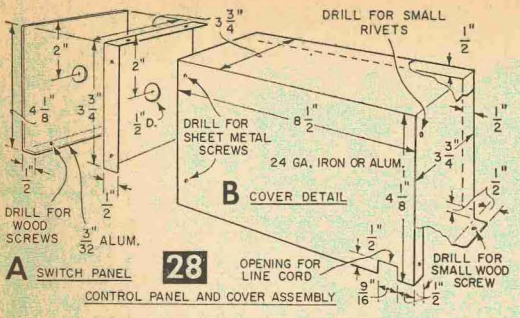


¾-in. diameter bar copper as in Fig. 25E. It may pay to make an extra set of electrodes as eventually they will burn down and after a few re-turning jobs, new ones should be installed. Keep the tip diameter about ⅛ to 5/32 in. by re-turning as needed.

The movable arm is supported in a bracket assembly detailed in Fig. 25C. The handle is a piece of ¼-in. gas pipe tightly pressed in a hole in the Bakelite cam. Slots in the bracket support allow the cam to be adjusted vertically for different thicknesses of material to be welded.

Mount the coil spring carefully (it goes between the two current-carrying arms so it must be insulated from them). First make up two pieces of ¼ in. thick Bakelite as spring seats into which the ends of the spring fit tightly in 3/32 in. deep





recesses. Apply a little Pliobond cement in each recess to further insure that insulated spring seats will stay in place. Attach the pieces to the arms with 6-32 screws and nuts, making sure there is good clearance from the springs.

With the transformer mounted to the base and the arms in place, you can attach the flexible conductor to one end of the secondary winding at a Bakelite terminal strip, as in Fig. 15. This conductor consists of six 1-in. wide, tinned or plated, flexible braided copper automobile battery ground strips, clamped together at their ends to form a heavy conductor for the welding current. The connections (Figs. 16 and 23) must be very tight and clean. Bolt the other end of the secondary to the ends of the strips running along the lower arm, using brass clamping plates, brass screws and nuts (Fig. 15). Make sure flats of electrodes come together perfectly when pressure is applied to the clamping arm. Slot holes in base of support brackets for upper arm so assembly can be moved slightly.

Welder Controls. The unit uses a heavy duty double-pole relay for control (Fig. 27); its contacts are connected in series to break up the arcing between the two sets of contacts. The two start ends of the primary winding are used for the line as shown in Figs. 27 and 29. The two 80-turn taps are connected together in a soldered, taped splice, which is tucked in under the transformer. The two 160-turn leads are taped up separately and not used.

If the unit is to be used on 230 volts, connect the two 160-turn leads and tape up separately the two 80-turn taps, which will then not be used.

Wiring from the shop fuse panel should be #10 and should terminate in an outlet with a receptacle to fit the plug. For 230-volt operation, a three-wire cord, plug and receptacle are used to provide a ground for the transformer.

If contact with the push switch is limited to the maximum of four to five seconds which will weld material up to the full capacity of the welder, a 30-ampere fuse will hold on 115 volts. A fuse of this rating with a time-delay element could be used if necessary to take the sudden surge of current without blowing, but in our tests, an ordinary fuse held all right.

Construction details on the control housing are shown in Fig. 28.

Figures 1 through 3 show the welder in action and some of the results—welding pieces of 1/16-in. and 3/32-in. steel together neatly in three seconds.

When making a weld, stand well back from the electrodes or else wear safety goggles. As a rule, there will be very little sparking, but sometimes sparks of molten metal may fly off.

Try to keep within the capacity of this unit or a maximum thickness of steel of 3/32-in. under normal conditions. If you attempt to weld thicker material, the fuse may blow or you may overheat the transformer in the longer time the electrodes are required to be together with the power on. Spot welding of heavy material is customarily done with large expensive floor model welders used in production. Material to be welded should be clean if you want to secure good electrical contact.

If you make an error in the directions for the wire turns or the placement of the coils on the core, the two coils may buck each other and draw line current even when there is no load.

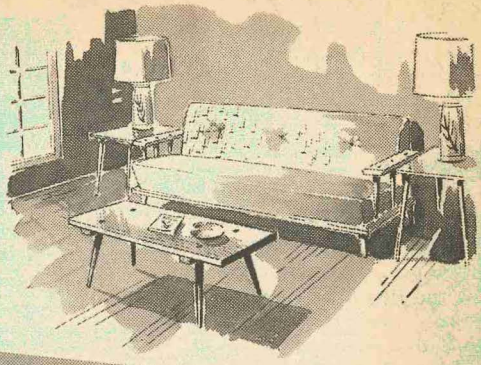
It is a good plan when first making the primary connections, to connect a 10-ampere fuse in a test line and after connecting the two 80-turn taps together (or the 160-turn taps in the case of 230 volts), apply power to the start ends of the winding. If all is well, the fuse should not blow. In this test the coils must have been placed on the core or the transformer must be fully assembled, of course.

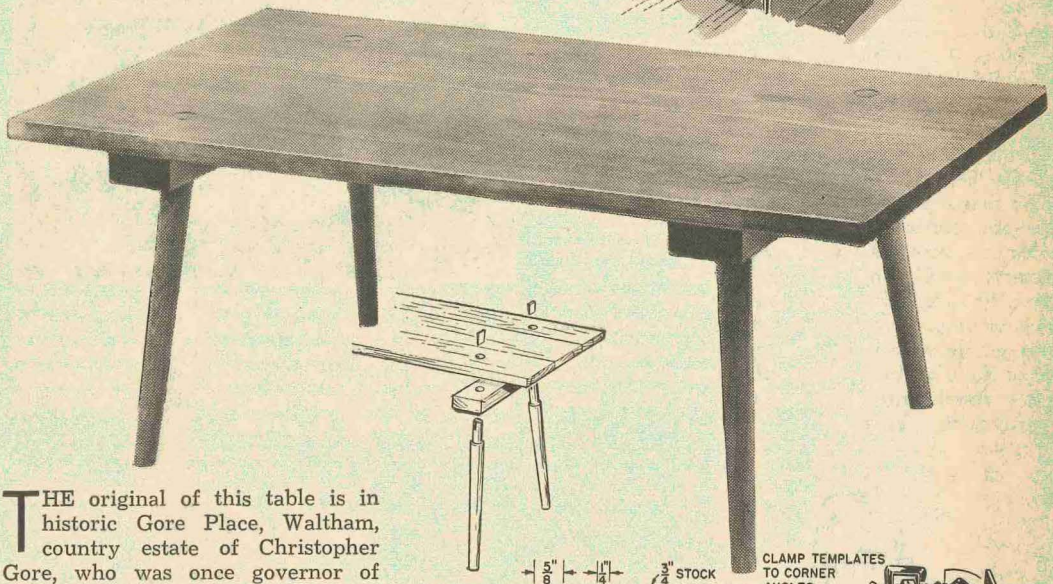
Turn off the power if this test is satisfactory.

Next, use a clip jumper to connect the two secondary leads together (Fig. 22), if you haven't already done so. Now, apply line current again and use a low reading *a-c* voltmeter on the two remaining secondary leads; you should get a reading of around 3 volts, the exact amount depending on line voltage and winding accuracy. Take care in these tests to avoid shock and to see that leads do not touch one another. Assuming that the work has been done correctly, the voltage test at the secondary indicates that the welder should work all right. For connections with Formvar insulated wire, any enamel insulation must be cleaned off the ends to be joined for good contact. This welder was designed for a 115-volt, 60-cycle line. If your voltage is usually low or 110-volt, use 75 primary turns on each coil; for 220 volts, use 150 turns on each of the coils.

Tub Table

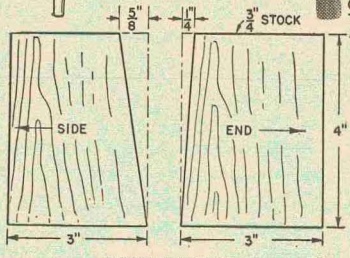
By NORBERT ENGELS



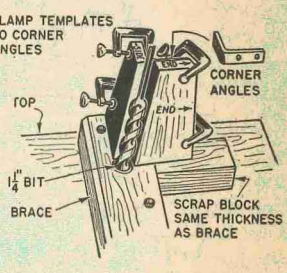


THE original of this table is in historic Gore Place, Waltham, country estate of Christopher Gore, who was once governor of Massachusetts. It was intended as a low table for holding wash tubs but, with its ample top and convenient height, its reproduction serves as a perfect coffee, cocktail or magazine table.

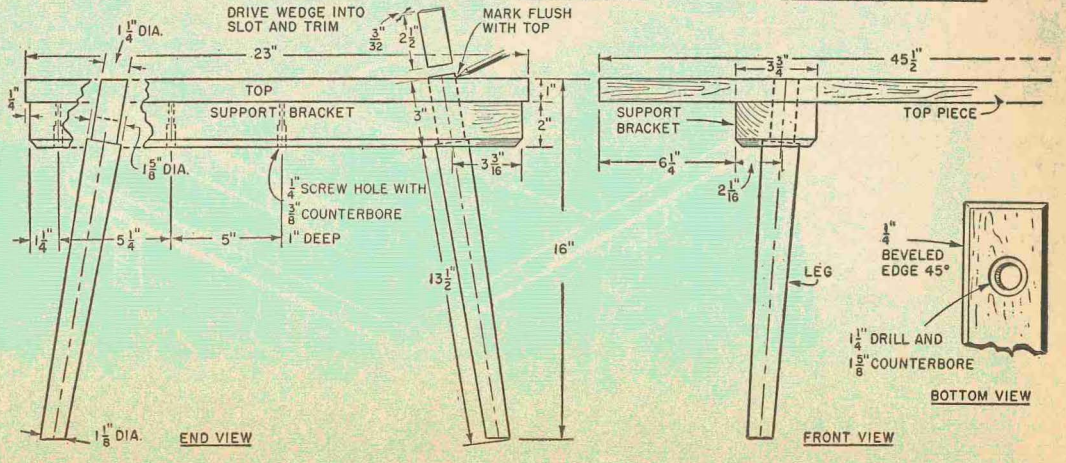
To make the top, glue up 1-in. solid white pine—often called "pumpkin" pine by New Englanders—with alter-



BORING TEMPLATES



DRILLING TEMPLATE ASSEMBLY



MATERIALS LIST—TUB TABLE

No.	Size	Item
4	1⅝ sq x 16½"	legs
2	2 x 3¾ x 22½"	support brackets
1	1 x 23 x 45½"	top (glued)
10	#14 x 1¾"	rh wood screws
4	3/32 x 1¼ x 2½"	wedges for legs

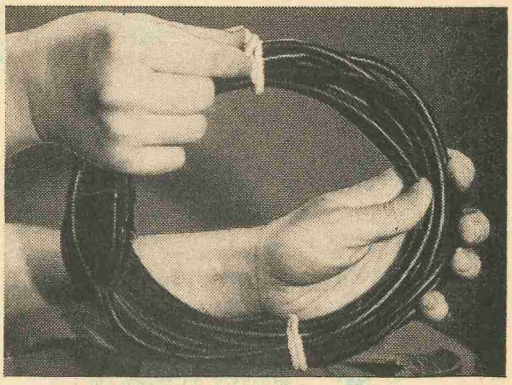
nating grain direction in adjoining boards. Turn the tapered legs of maple or birch on the lathe with a heavy dowel end on each leg. Saw a 1/16 in. slot the depth of each dowel end, across grain, for securing the leg into the support bracket and top with a wedge.

Shape the maple or birch support brackets, beveling ½ in. all along the bottom edges, then drill for screw holes and leg holes using a template to get proper angles for splaying legs outward both at sides and ends. Attach brackets to top. Bore leg holes through top piece, clamping a piece of scrap wood securely to table top to prevent splintering when bit breaks through.

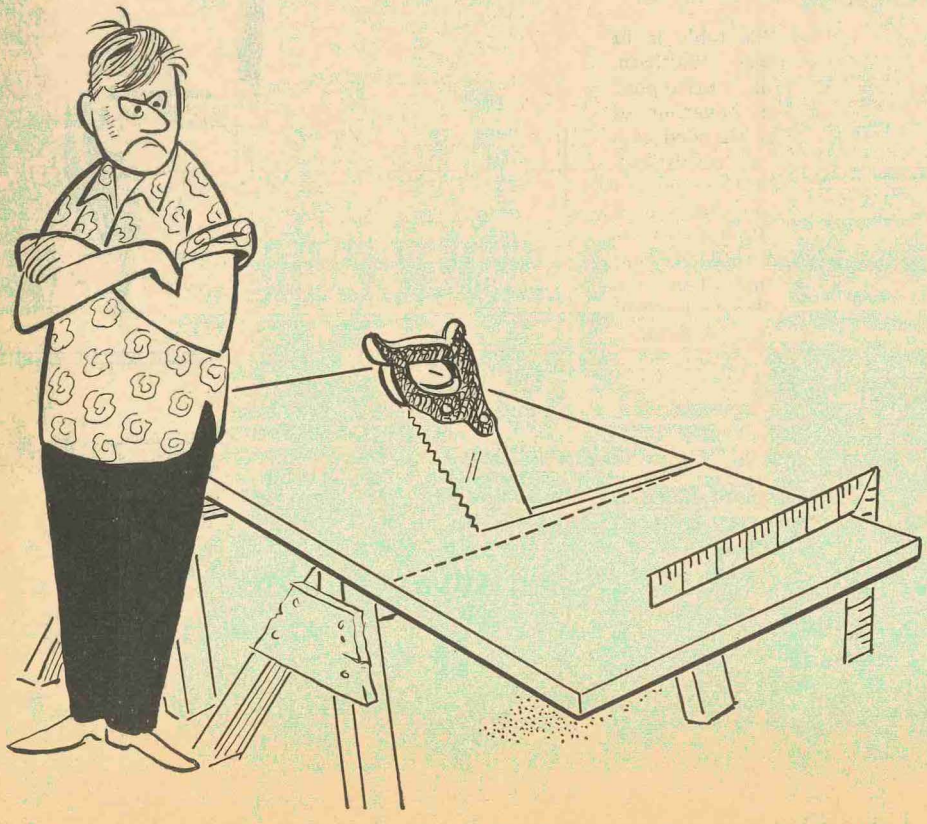
Make a preliminary assembly without glue, to mark cut-off points for legs at floor and table top. Be sure wedge slots are crosswise to grain of table top. Saw legs at angles indicated, and reassemble with glue. Use glue on wedges, and drive them in flush. Wipe off excess glue and let table stand until glue is well set, then sand lightly with #00 paper.

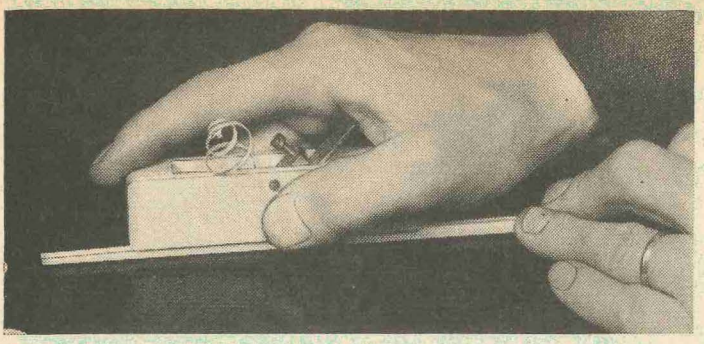
To finish, apply one coat of stain, then one coat of varnish. When dry, rub with water and rottenstone. Clean thoroughly, then apply a coat of rubbed-effect varnish and go over it lightly with rottenstone. Clean thoroughly once more, then rub on several coats of paste wax, polishing each coat vigorously for a lustrous finish.

Snarl-Proof Power Cords



• Long power cords carried on the job or kept in a drawer get all jumbled and snarled together? To keep each one separate and neat, just coil cord as usual and wrap one or two pipe cleaners around it as shown to secure.—FRANK A. JAVOR.





Model Builder's Plane

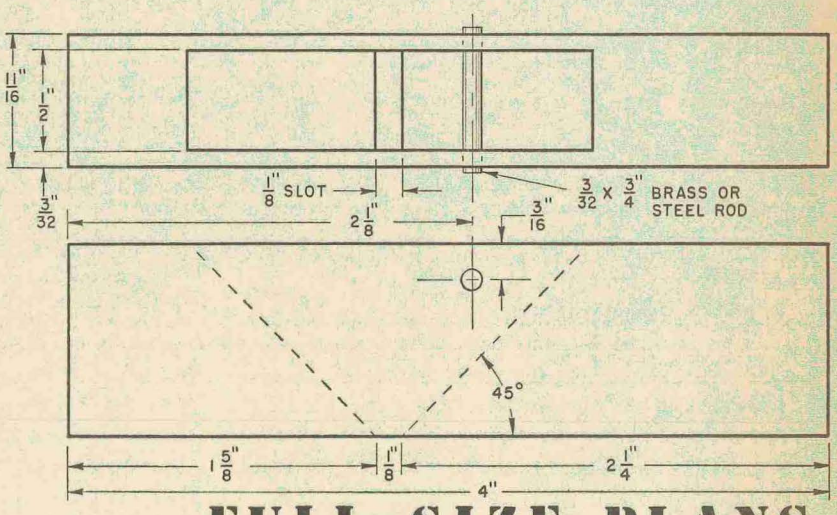
THIS little plane was designed especially for model builders, particularly for making ship's masts and spars, but you'll find other uses for it in your shop too. It is best made of hard wood such as boxwood, lemon wood, maple, beech, or hard mahogany.

Square up and sand down a block of wood $1\frac{1}{16}$ x 1 x 4 in. and lay out the part to be chiseled out from the full-size plans. Drill a series of holes in the bottom with a $\frac{1}{16}$ in. drill, keeping the holes just inside of the slot lines. Now turn the block right side up and clamp in a vise, protecting sides of block with scrap wood, and score outline of the throat with a sharp knife a little inside the lines. With a $\frac{3}{8}$-in. chisel and mallet proceed to cut out the opening using very light mallet blows. Start at the middle and work out toward the ends. Continue cutting in this way until you can see the holes you drilled in the bottom. From here on, it is best to drive the chisel by hand, truing up the sides of the throat and smoothing it as you go along. True up the slot in the bottom with a small flat file.

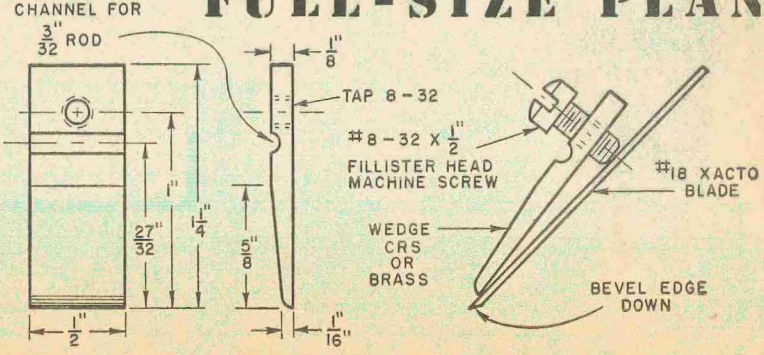
Next make the wedge, carefully shaping the tapered edge with a file. You can, of course, make the plane blade out of any piece of thin $\frac{1}{2}$ in. wide tool steel, but a low-cost #18 XActo blade will do the job and save you work. To locate the $\frac{3}{32}$-in. rod in the plane, place the wedge and plane in cutting position in the plane, then mark and drill for a snug fit with the rod. Peen the ends slightly so the rod will stay in place. The beveled cutting edge of the plane blade is placed the same as in a regular size plane. The depth of cut is controlled by gently tapping the end of the plane blade. Wax and polish the plane if you like, but do not wax the bottom.—WINTHROP PRATT, JR.

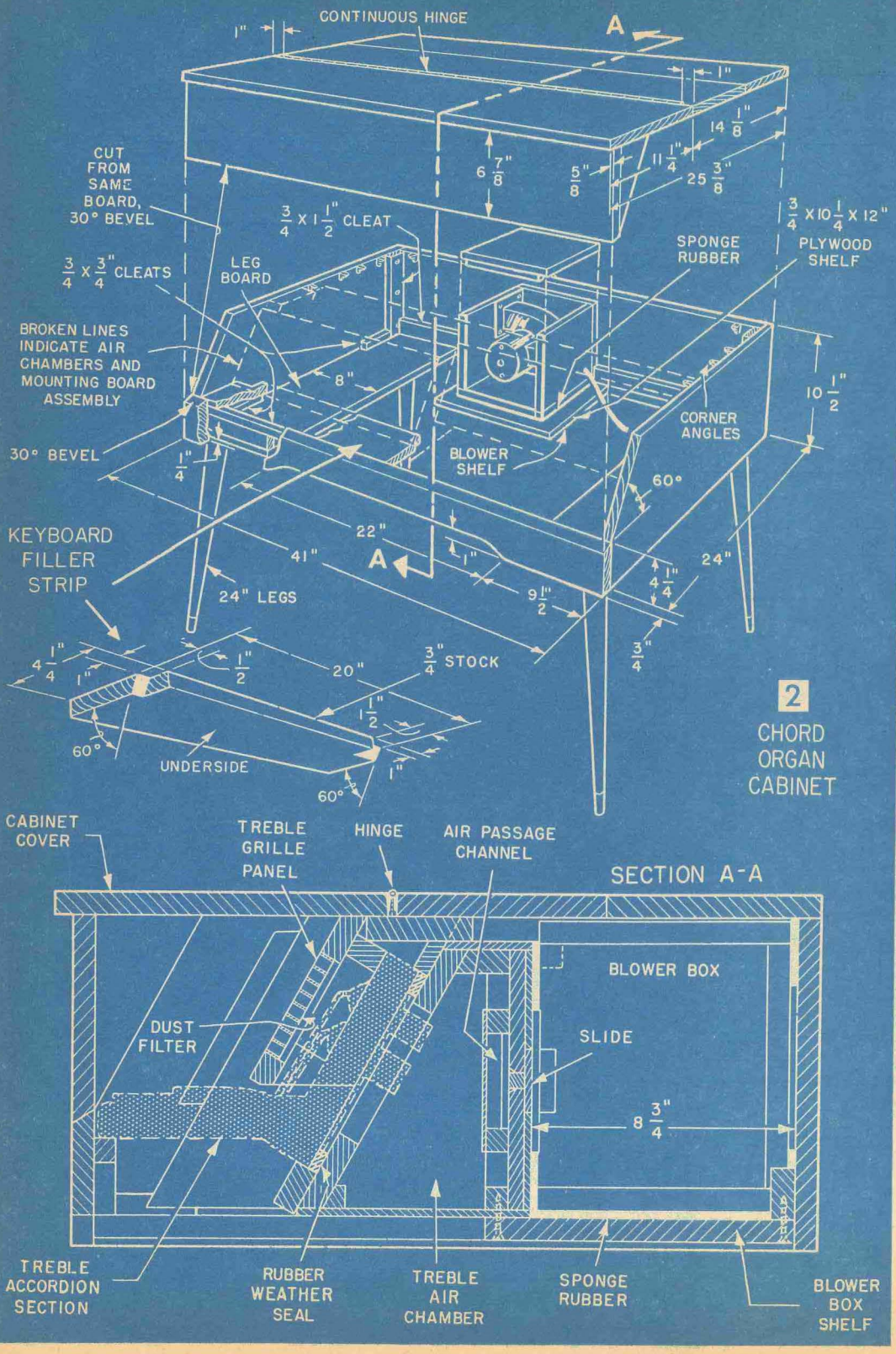
MATERIALS LIST—MODEL BUILDER'S PLANE

No. Reqd.	Description	Use
1 pc.	$1\frac{1}{16}$ x 1 x 4" boxwood	plane body
1 pc.	$\frac{1}{8}$ x $\frac{1}{2}$ x $1\frac{1}{4}$" brass or steel	wedge
1 pc.	$\frac{3}{32}$" D x $\frac{3}{4}$" brass or steel rod	wedge pin
1	#8-32 x $\frac{1}{2}$" fillister-head machine screw	wedge screw
1	#18 Xacto blade	



FULL-SIZE PLANS




CONTINUOUS HINGE
1"
A
1"
14 1/8"
11 1/4"
25 3/8"
6 7/8"
5/8"
CUT FROM SAME BOARD, 30° BEVEL
3/4 X 1 1/2" CLEAT
3/4 X 10 1/4 X 12"
PLYWOOD SHELF
SPONGE RUBBER
3/4 X 3/4" CLEATS
LEG BOARD
BROKEN LINES INDICATE AIR CHAMBERS AND MOUNTING BOARD ASSEMBLY
8"
10 1/2"
CORNER ANGLES
30° BEVEL
1/4"
BLOWER SHELF
60°
KEYBOARD FILLER STRIP
22"
41"
A
1"
24"
4 1/4"
24" LEGS
9 1/2"
3/4"
4 1/4"
1"
1/2"
20"
3/4" STOCK
1 1/2"
60°
UNDERSIDE
1"
60°
2
CHORD ORGAN CABINET
CABINET COVER
TREBLE GRILLE PANEL
HINGE
AIR PASSAGE CHANNEL
SECTION A-A
BLOWER BOX
DUST FILTER
SLIDE
8 3/4"
TREBLE ACCORDION SECTION
RUBBER WEATHER SEAL
TREBLE AIR CHAMBER
SPONGE RUBBER
BLOWER BOX SHELF

1

Quality Chord Organ

3-Octave, 120-Bass

Full Quality Musical Tone

Performance Equal to $250 Commercial Units

Treble and Bass Balance Blender

Foot Pedal Volume Control

Fast, Responsive Action of Keys

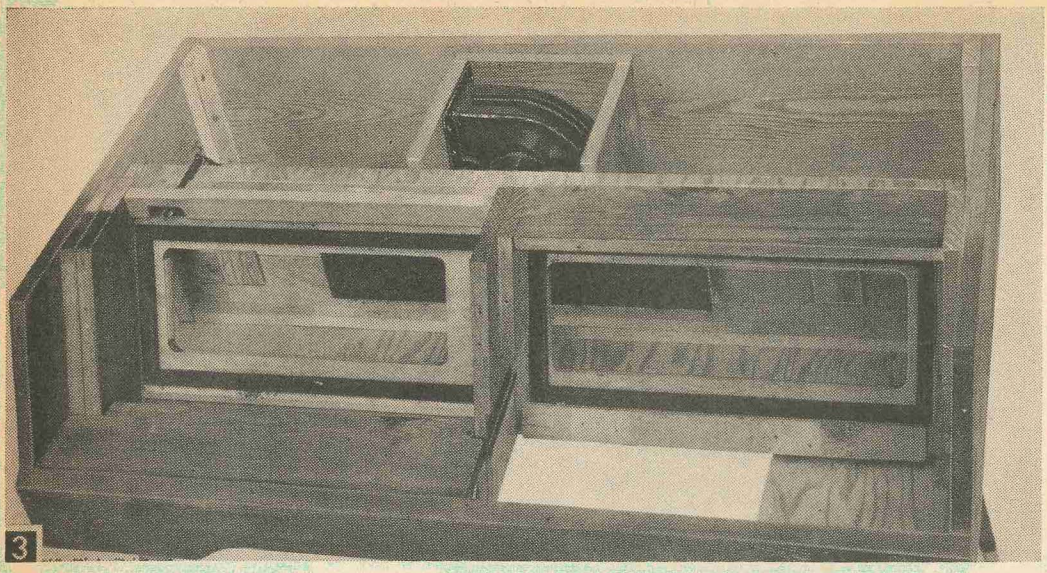
Fold-Top Design Doubles as Table

YOU are guaranteed a fine musical instrument—and not a bargain basement toy—when you build this electric organ. Its design takes advantage of the best features found in good accordion design—fast, responsive key action through 3 octaves of treble keys and 120 rich bass chords. But the work of squeezing and wheeze of an accordion bellows are eliminated by using an electric blower. The design—developed by R. W. Turnbull—incorporates such special quality features as separate controls for bass and treble, and a pedal volume control.

One used accordion, a blower and some simple cabinetry are the basic ingredients.

Practically any make or size used accordion will do. Ours was a 1936 Wurlitzer model, and we have priced many other types at from $10 to $25 and up (see Materials List for sources). A leaking bellows won't matter, because all you will use are the keyboard and reed sections. Key and chord button action should be good. Reeds are held in place by wax seals, so if any are loose or leaky, they can be resealed as in Fig. 7.

To operate the organ, air must be drawn across the reeds by a small constant-speed blower, of a constant-speed type so there



3

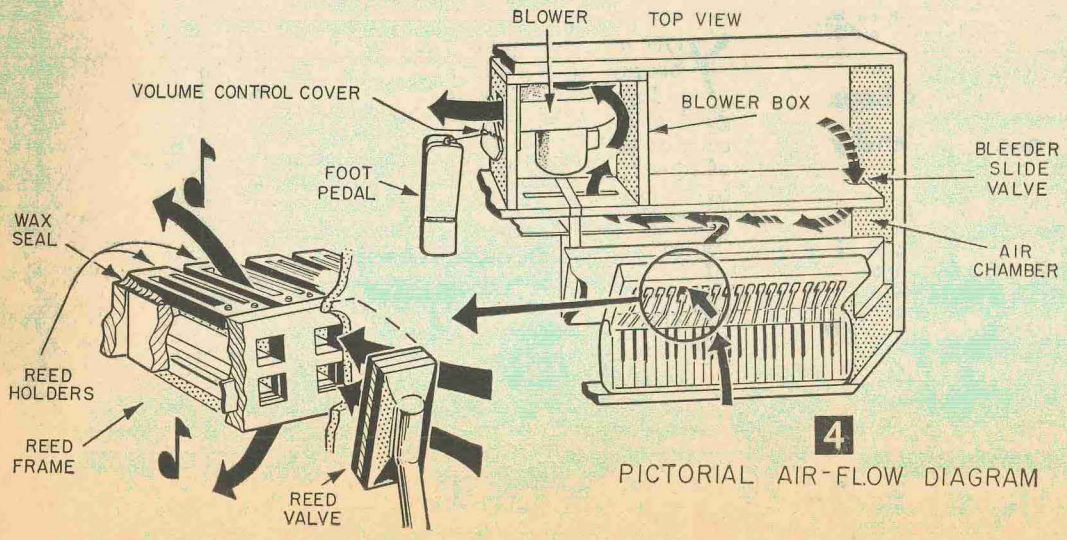
Gaskets of black rubber weather strip seal accordion sections to mounting board and to air chambers. Note blower mounted in box in rear.

will be no swell or fade to the sound (Fig. 4). The foot pedal and bleeder valves in this design regulate the air flow, thus enabling you to control volume, as well as vary the ratio of sound between the treble and bass sections.

The blowers specified in the Materials List will work well. Or, if you have a small one on hand, you can test it by sealing up the inlet, and connecting it with rubber tubing to a glass tube immersed vertically in a glass of water. A blower that pulls at least ½-in. of water up the tube will operate the organ; one that will pull ½-1½-in. of water will give you controlled volume on the whole range.

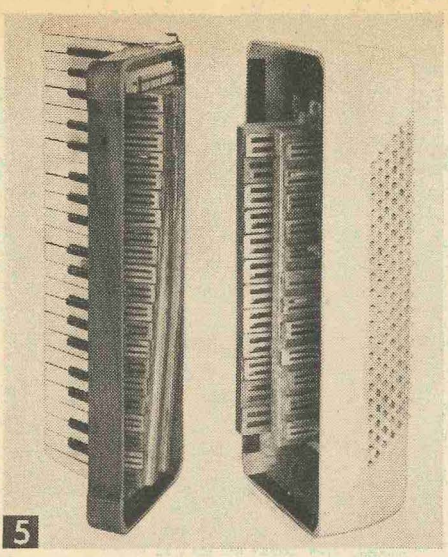
Preparing the Accordion. First remove the accordion bellows, which are usually held in place by pins or screws through the end frames (Fig. 5). If any of the reed holders are loose you can repair them by melting and resealing with a soldering gun (as in Fig. 7). If you intend to permanently install the accordion parts in the organ, you can make an optional improvement by shellac sealing the unused reed in each holder (the one not covered by a leather flap visible on the outside —see Fig. 8).

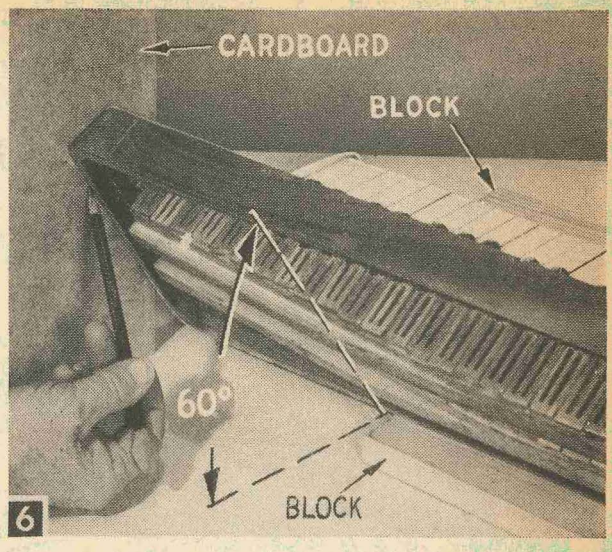
The mounting boards for the accordion keyboard use rubber seals to prevent air leaks (Fig. 3). Remember that the plan-view (Fig. 2) is based on the Wurlitzer 120 Bass accordion we used, and you should adjust the mounting board dimensions, and also the overall cabinet length and width, to fit the



4

PICTORIAL AIR-FLOW DIAGRAM





Here are the key and reed sections—the only parts you need from the used accordion (Fig. 5). Bellows is not needed. To measure mounting angle of accordion, block up accordion section parallel to bench and draw the angle on a vertical board (Fig. 6).

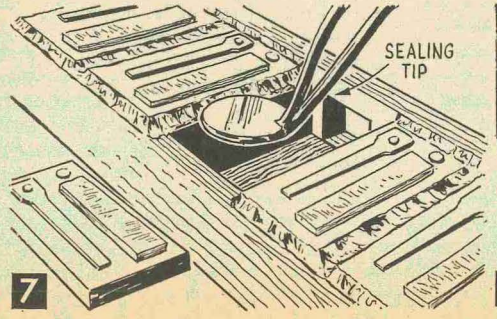
make of accordion that you obtain.

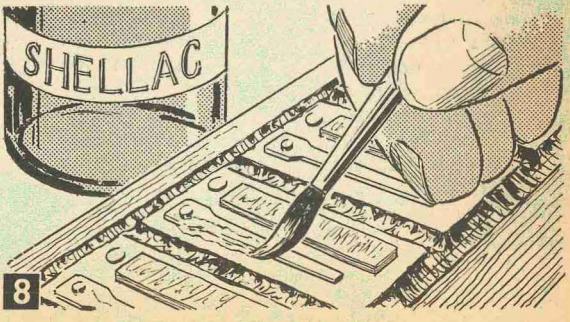
With the reed frames removed, check the backs of the accordion end housings to make sure they are perfectly flat, filing the plastic, if necessary, to make sure of a good seal. Then block up the keyboard section, so the keys are parallel to the bench, and check the back angle, as in Fig. 6. Our accordion measured 60°, so if your measured angle is different, be sure to change construction as required. (Note: If you are using an expensive accordion, you may want to preserve its use as an accordion. With many makes you can improvise a wood fitting equal in size to the bellows frame, which will enable you to remove both treble and bass sections quickly from the organ.)

Now block up the keyboard section to the right of the chord button section, working on a flat bench so that the back surfaces are in the same plane and spaced 1½-in. apart. Make the mounting board of ¾-in. plywood, three inches longer than the overall length of the two accordion sections, and three inches wider than their back width. Cut holes to clear the reed holders and other projecting parts. Then bevel the top and bottom edges of the mounting board to match the angle measured earlier.

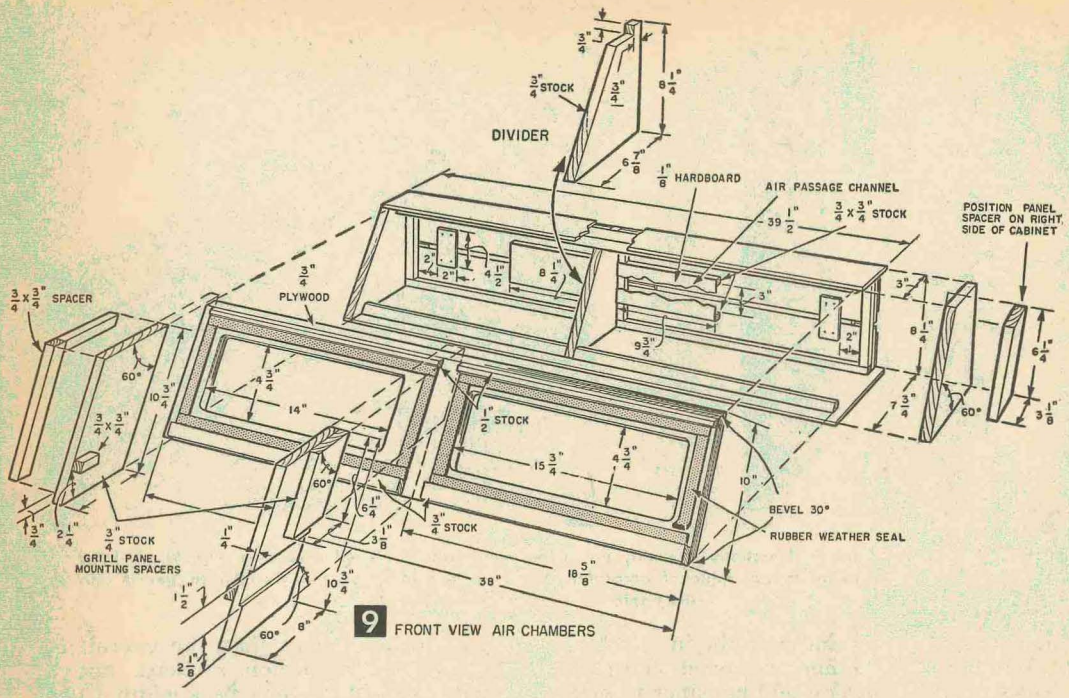
With the mounting board blocked up on the bench, place the accordion sections in position, and pencil the outlines of the backs. Along the top of each section, nail a length of ½-in. square stock to act as a top guide, and allowing a loose fit for the accordion sections, nail a section of 1-in. stock outside the bottom pencil marks. Shellac the front surface of the mounting board, allow it to dry a day, and then apply sponge rubber weather stripping inside the pencil marks, as in Fig. 9.

The accordion sections are held in place by the grille panels, which are, in turn, fastened into the panel mounting spacers with screws. Place the accordion sections in their proper





Use a plastic sealing tip on your soldering gun to melt wax and reseal any loose or leaky reed holders (Fig. 7). If you plan to permanently install accordion parts, you can get quicker tone response and avoid air leaks by sealing unused reeds with shellac (Fig. 8).



9 FRONT VIEW AIR CHAMBERS

positions on the mounting plate, and tape them temporarily. Outline a set of fitted spacer blocks which will locate the front grille panels just right to grip the accordion sections, and so that they clear the accordion valve lifters when the keys are depressed.

Air Chambers. Make the two sides and center divider of the air chambers of ¾-in. solid wood as in Fig. 9, with the 60° angle (or the angle of your accordion) cut at the front. Nail the dividers to the mounting board and cut the two pieces of ½-in. plywood which fit in between. Make the slots and sliding valve parts as in Figs. 14 and 10.

The lever linkage made of strap metal provides a means of adjusting the volume of air flowing through slot C and thus you can control the amount of sound produced by the bass chord reeds while playing the instrument. Bleeder valves A and D give you a means of reducing the air suction to either the treble or bass sections, so that you can adjust your organ to play very softly or for any desired volume.

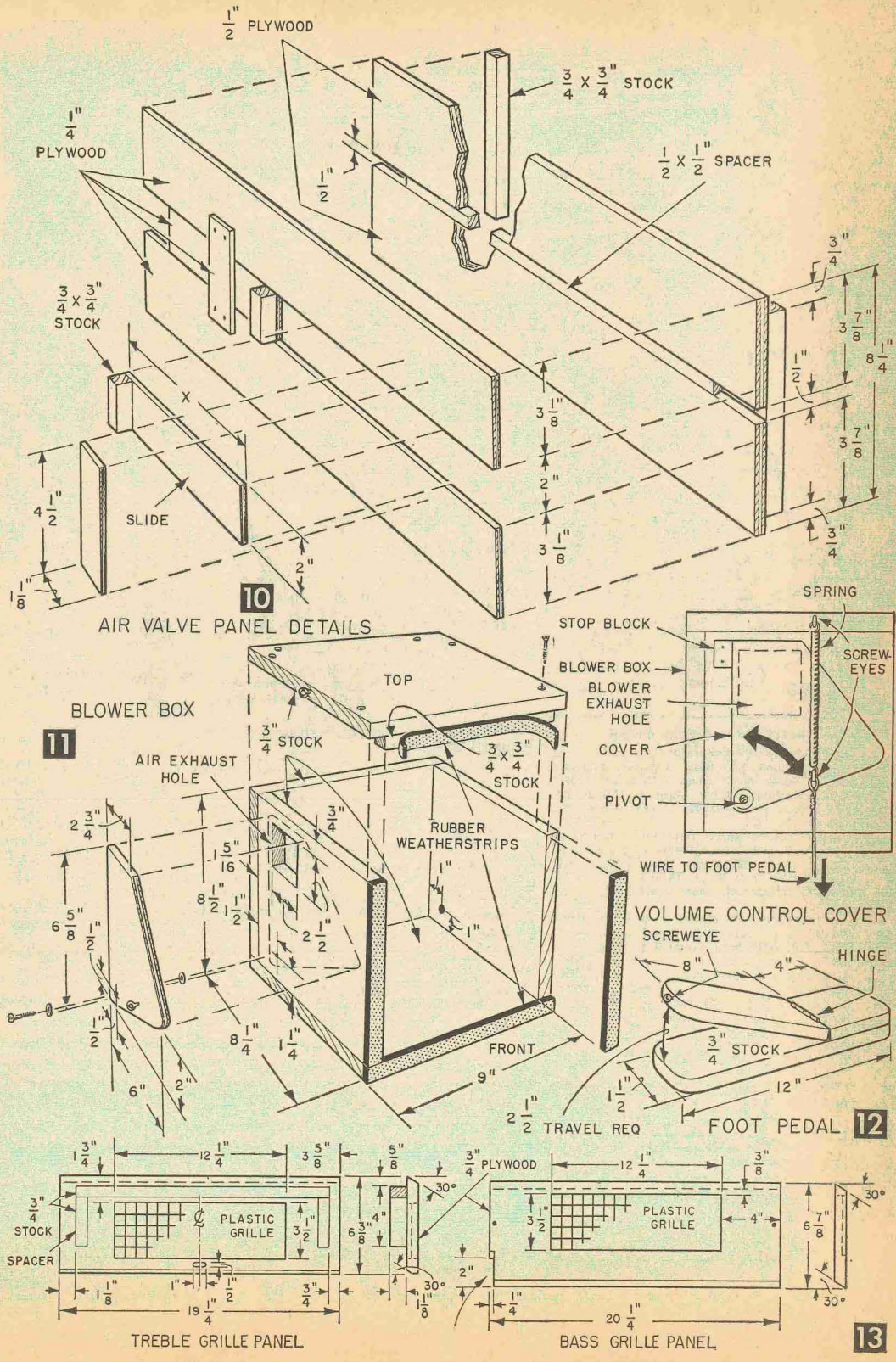
Make the air passage channel (see Fig. 9) of ¾-in. square strips of wood and hardboard. It serves to draw the air as much as possible from the center of each reed chamber. Before final assembly, sand the valve parts and channels carefully, and round the sharp corners of each air slot with a wood rasp to prevent air "hissing." Cover the top of the reed chambers with ¼-in. plywood or hardboard.

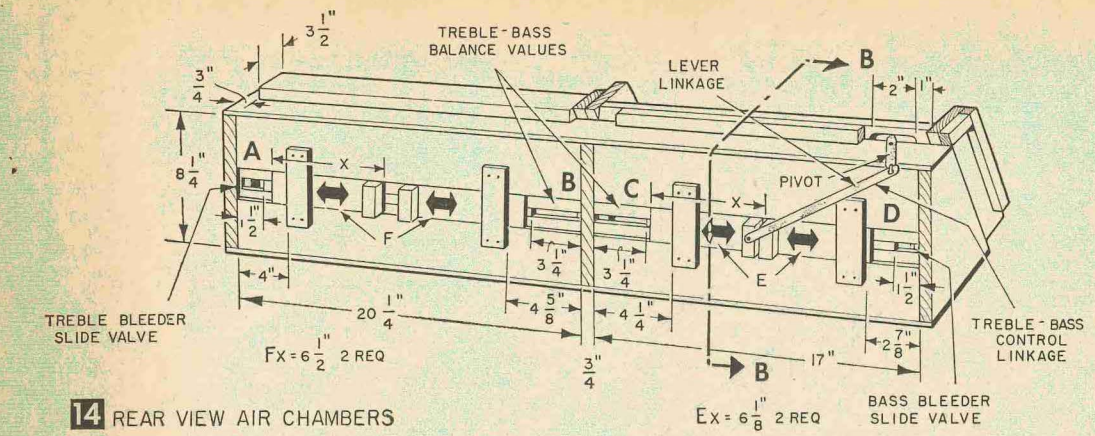
Blower Box. To minimize motor vibration, the blower box is supported by a shelf covered with rubber, and is sealed to the air chambers with weather seal. Make the box of ¾-in. lumber (Fig. 11) and use screws for easy disassembly. The spring-return pivoted cover is the main volume control for both treble and bass sections; with no foot pedal pressure, there will be no sound. When you press the foot pedal all the way down, sound volume will be maximum. Select a spring for the pivoted cover and adjust so it gives you the right "feel" for the foot pedal.

Cabinet Construction. Walnut, mahogany, pine, or maple can be used for the cabinet. Construction details are shown in the plan-view drawings. The 24-in. legs used are stock items (see Materials List).

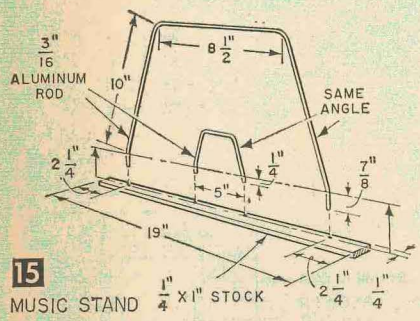
Since the dimensions of your accordion may not match those of the accordion shown in the plan-view, place your completed reed chamber and blower box on a flat surface, and check the inside clearance dimensions for length and width of the cabinet parts. The cover of the cabinet folds back, and its bottom edge is beveled at 30°. This bevel, which is also cut on the front board, provides clearance for playing the treble keys. The bottom of the front board is cut out for legroom and decorative effect. Fasten the top boards from inside with small angles, or desktop fasteners to eliminate unsightly nail marks.

Filter Grille Panels. The front grille panels do a double job. They clamp the accordion sections in place, and they also filter the incoming air. Since the accordion reeds will clog if dust accumulates, back these filter grilles with heavy cotton cloth, or use a decorative grille cloth. The grille shown in

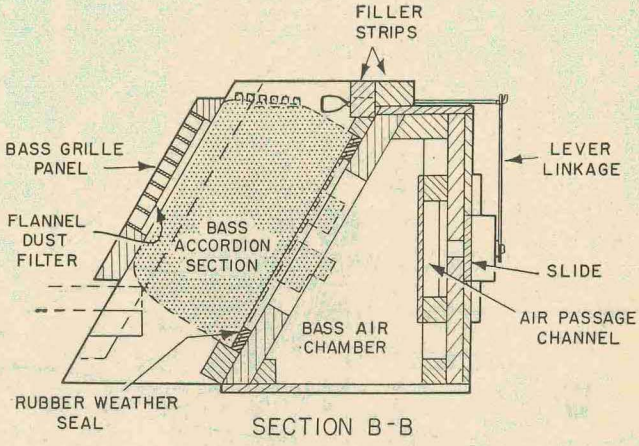

1/2" PLYWOOD
3/4 X 3/4" STOCK
1/4" PLYWOOD
1/2" X 1/2" SPACER
3/4 X 3/4" STOCK
SLIDE
10
AIR VALVE PANEL DETAILS
SPRING
STOP BLOCK
SCREW-EYES
BLOWER BOX
BLOWER EXHAUST HOLE
COVER
PIVOT
WIRE TO FOOT PEDAL
TOP
BLOWER BOX
11
3/4" STOCK
3/4 X 3/4" STOCK
AIR EXHAUST HOLE
RUBBER WEATHERSTRIPS
FRONT
VOLUME CONTROL COVER
SCREWEYE
HINGE
3/4" STOCK
2 1/2" TRAVEL REQ
FOOT PEDAL
12
3/4" STOCK
SPACER
PLASTIC GRILLE
TREBLE GRILLE PANEL
3/4" PLYWOOD
PLASTIC GRILLE
BASS GRILLE PANEL
13



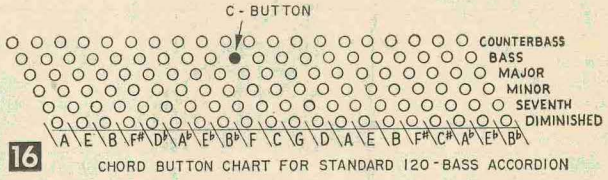
14 REAR VIEW AIR CHAMBERS



15 MUSIC STAND



SECTION B-B



16 CHORD BUTTON CHART FOR STANDARD 120-BASS ACCORDION

MATERIALS LIST—CHORD ORGAN

No. Req'd	Size and Description
1	used accordion 120 Bass, 3-Octave, available through local music stores, instrument repair shops, accordion dealers (such as Italian Accordion Co., 7600-A South Cottage Grove Ave., Chicago 19, Ill.).
1	Dayton #2C610 blower from Dayton dealers or from R. W. Turnbull, 4 Ferncliff Rd., Barrington, N. Y., for about $16. Special blower kit, also available from R. W. Turnbull for $23.75, provides considerably more control and sound volume
4	24" table legs with mounting plates (available for $5.25 postpaid from Siegal Lumber Co., Dept. SM, 4815 West Grand Ave., Chicago 39, Ill.)
1	3/4 x 10 5/8" x 12' pine, mahogany or walnut (cabinet)
1	3/4 x 11 5/8 x 48" pine, mahogany or walnut (lid)
1	3/4 x 7 5/8" x 8' pine, mahogany or walnut (covers)
1	3/4 x 9 5/8" x 10' pine (blower box, air chamber and cleats)
1	3/4 x 24 x 32" fir plywood (leg boards and air chamber)
1	3/4 x 10 x 40" fir plywood (air chamber)
1	1/2 x 18 x 20" fir plywood (air chamber)
1	1/4 x 18 x 24" fir plywood (air chamber)
1	10 3/4 x 23 1/2" plastic louver, white, 5/8" cells, ($3 postpaid) from S & J Electric Supply, 5119 N. Winchester Ave., Chicago 40, Ill.
2	cloth filters for above. Heavy flannel trimmed to fit
1	5/16 x 3/4" x 10' roll, self sticking sponge rubber weather seal (auto supply stores)
1	3/32 x 1/2 x 24" steel strap (control lever)
1	3/8 O.D. 3 3/4" tension spring (blower box)
1	1/2 x 48" cabinet hinge (cover)
4 doz.	#7 x 1 1/4" fh wood screws
1 doz.	corner angles, or desk top fasteners
1	3/16 x 36" steel or aluminum rod (music rack)

Finishing nails, shellac, cabinet glue, wood sealer, stain, wax, foot pedal cable and scrap hardwood strips.

Fig. 13 is available from plastic molding houses, and the same kind of material can also be obtained from interior decorators, and some electrical supply houses. Cut and bevel the front panels to fit. Fasten these panels with wood screws for easy removal, applying just enough pressure to hold the accordion sections firmly in place.

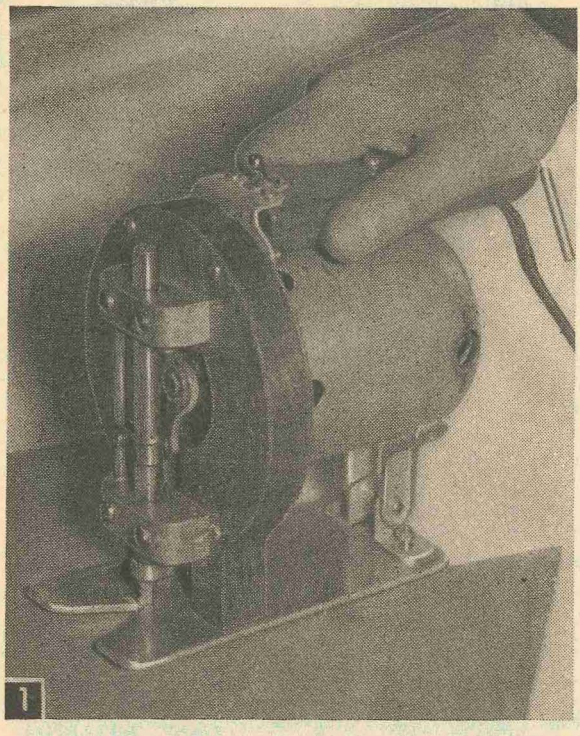
Construct the foot pedal as in Fig. 14, and connect it to the volume control valve with flexible wire or chain.

It should be adjusted so that the spring provides a 3 to 5-lb. pull for comfortable pedal action. The bent ends of the music stand rod (Fig. 15) fit in holes drilled inside the fold-back cover.

The chord chart shown in Fig. 16 can be added for quick identification of the bass chord buttons.

Simplified accordion instruction books, available in most music stores, will help you to master playing technique quickly.

SABER SAW Powered by an Old Vac Motor



Motor support, handle and bearing blocks are of maple, smooth sanded and finished. Saw is especially suited for cutting irregular shapes, disks, also large sheets difficult to handle on rigid-type saws.

By CARL S. BATES

THAT old vacuum cleaner you retired a while back may be just what you need to make the modern saber saw shown in Fig. 1.

This modern power tool, which performs much of the work of cross-cut, rip, scroll, keyhole and band saws, requires the same type of motor the cleaners used to have —a high speed *ac-dc* universal type. It has the advantage of small size and light weight for the power developed, and it can be slowed down considerably under load without damage.

If you don't have such a "vacuum," you can buy it from a dealer in used cleaners (the one used here was an all-steel Torrington purchased in good condition for $2). Be sure the motor runs smoothly. A pair of new carbon brushes usually is enough in the way of replacements. In some cases, you may need a new bearing at the power end for efficient performance.

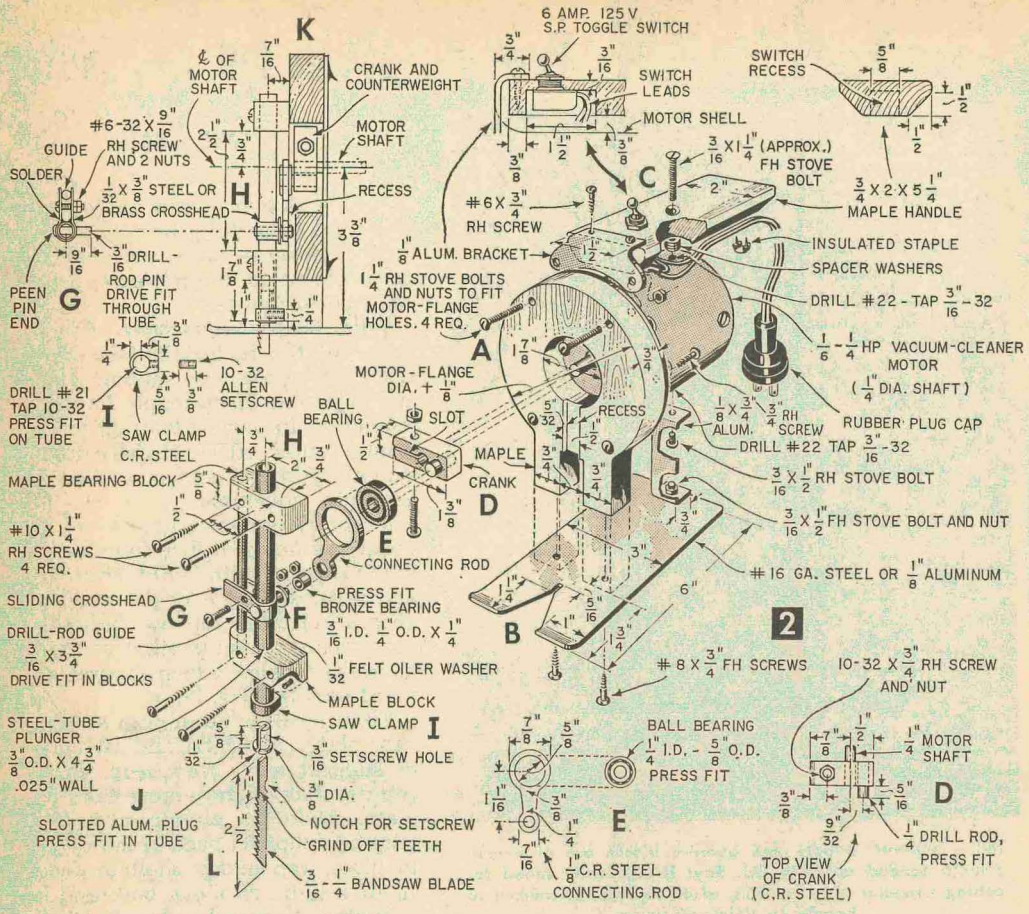
Motor Support—Assembly. After gathering all the materials (see Materials List), make a motor support (Fig. 2-A and K) from ¾-in. maple having a diameter ⅛ in. larger than motor flange. Round outer edges slightly and sand smooth. Also recess face to clear crosshead-pin movement.

Motor flange has a number of attaching screw holes; utilize four for attaching to support with 1¼-in. *rh* stove bolts and nuts, and two for *rh* wood screws (Fig. 2-A). The top two bolts also secure an aluminum bracket, shaped to fit flange and holes, which secures a hardwood handle (Fig. 2-C).

From steel or aluminum sheet, cut a base plate (Fig. 2-B) and attach to legs of support with #8 x ¾-in. *fh* screws countersunk slightly more than flush in plate. Make an aluminum angle of a length to support back of motor parallel to plate; tap motor shell to receive a 3/16-in. x ½-in. *rh* stove bolt, and secure to motor. Secure bracket to base plate

MATERIALS LIST—SABER SAW

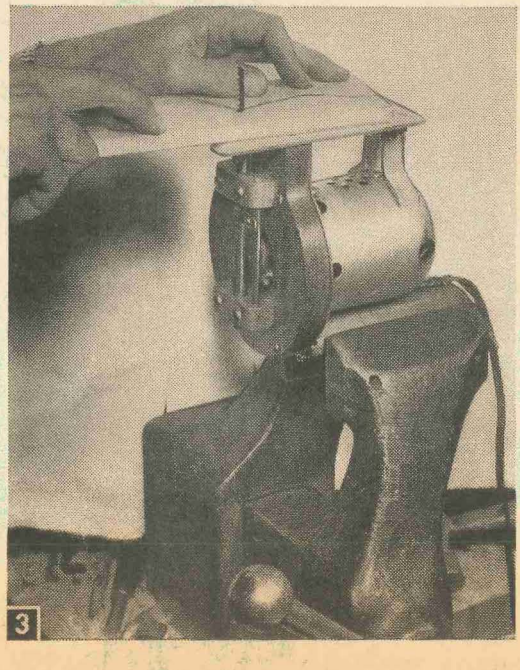
No. Req.	Size and Description	Use
1	vacuum cleaner motor, ⅛ to ¼ hp. universal	ac-dc, ¼-in. shaft
1	S.P. toggle switch, 6-amp., 125 v.	
1	#18 plastic-covered rip cord, length to suit	
1	rubber attachment plug cap	
1 pc	maple, ¾ x 5 x 6″ (approx.)	motor mount
1 pc	maple, ¾ x 2 x 5¼″	handle
2 pcs	maple, ⅝ x ¾ x 2″	bearing blocks
1 pc	#16 ga. x 3 x 6″ steel, or ⅛″ aluminum	base plate
1	⅛″ aluminum bracket to fit motor flange	handle support
1	⅛ x ¾″ aluminum bracket	motor support
1 pc	cold-rolled steel, ½ x ½ x 1⅜″	crank-counterweight
1 pc	cold-rolled steel, ⅛ x ⅞ x 1¾″	connecting rod
1 pc	steel or brass strip, 1/32 x ⅜ x 6″	crosshead
1 pc	steel tubing, .025″ wall x ⅜″ o.d. x 4¾″	plunger
1 pc	drill rod, 3/16″ dia. x 3¾″	crosshead guide
1 pc	drill rod, 3/16 x ⅞″	crosshead pin
1 pc	drill rod, ¼ x 1 3/16″	crank pin
1 pc	aluminum rod, ⅜″ o.d. x 21/32″	saw-blade plug
1 pc	cold-rolled steel, ¼ x ½ x ⅝″	saw-blade clamp
1	Allen setscrew, #10-32 x ⅜″	saw-blade clamp
1	ball bearing, ¼ x ⅝″ o.d.	connecting-rod bearing
1	bronze bearing, 3/16 i.d., ¼ o.d. x ¼″	connecting-rod bearing
2	rh (roundhead) screws, #6 x ¾″	bracket-handle attachment
4	rh wood screws, #10 x 1¼″	bearing-blocks attachment
2	fh (flathead) wood screws, #8 x ¾″	base-plate attachment
2	rh wood screws, ¾″	to fit motor-flange holes
4	rh stove bolts and nuts, 1¼″	to fit motor-flange holes
1	fh stove bolt, 3/16 x 1¼″ (approx.)	handle-motor attachment
1	fh stove bolt, 3/16 x ½″ and nut	bracket-base-plate attachment
1	rh stove bolt, 3/16 x ½″	bracket-motor attachment
1	rh machine screw, #10-32 x ¾″ and nut	crank-motor-shaft attachment
1	rh machine screw, #6-32 x 9/16″ and nuts	crosshead adjustment



with a 3/16-in. x 1/2-in. *fh* stove bolt and nut (Fig. 2-B).

Next, make a handle from 3/4-in. maple as shown in Fig. 2-C; recess to receive a 6-amp., 125-v., S.P. toggle switch and attach switch. Connect one switch wire to one motor wire and other switch wire to one wire of a length of #18 plastic-covered line rip cord; connect remaining motor wire to remaining line wire (Fig. 2-C). Solder all splices and cover with electrical friction tape. Tap top back of motor shell to receive a 3/16-in. x 1 1/4-in. *fh* stove bolt and attach handle to back of motor, using washers as separators to secure handle parallel to motor. To keep line cord in place under handle, secure with an insulated staple (Fig. 2-C).

For the crank-counterweight, use 1/2 x 1/2-in. cold-rolled steel bar (Fig. 2-D). Drill a 1/4-in. hole for motor shaft and a hole reamed for a press fit of the 1/4-in. dia. crank pin. Saw a



Tool becomes a rigid scroll saw when you clamp handle in a vise. It is particularly suited for jig sawing stock difficult to hold for saber sawing.

slot in crank and drill a #9 hole to receive a #10-32 *rh* screw and nut which serves to clamp crank tightly on motor shaft.

From ⅛-in. cold-rolled steel plate, make a connecting rod as in Fig. 2-E, reaming for a press fit of a ⅝-in. o.d. ball bearing having a ¼-in. i.d. for a press fit on crank pin. Ream other end of connecting rod for a press fit of a ¼-in. o.d. bronze bearing with a 3/16-in. i.d. (Fig. 2-F).

Saw-holder—Plunger Assembly. Make two bearing blocks (Fig. 2-H) from ¾-in. maple, boring ⅜-in. holes for a slide fit of the ⅜-in. o.d. steel-tube plunger, and holes for a drive fit of a 3/16-in. dia. drill-rod guide for crosshead.

Make the crosshead (Fig. 2-G) from 1/32 x ⅜-in. steel or brass, locating on steel tube as in Fig. 2-K, and solder. At *exact* right-angles (90°) to crosshead, drill through assembly a hole for a drive fit of a 3/16-in. dia. connecting-rod pin. Assemble and peen over pin end (Fig. 2-G). Drill a #27 hole through crosshead to receive a #6 x 9/16-in. *rh* screw and nut, which serves to adjust pressure of crosshead for a sliding contact with guide rod; a second nut serves as a lock nut to hold adjustment.

Make the saw clamp from ¼-in. cold-rolled steel (Fig. 2-I); drill a hole and ream for a press fit on steel tube. Drill and tap clamp for a #10-32 Allen set screw having a cup center. Turn a saw plug (Fig. 2-J) from a piece of aluminum rod for a press fit in tube; slot to receive thickness of saw blade and drill a 3/16-in. hole to pass setscrew.

Attach plunger assembly (Fig. 2-H) to motor support (Fig. 2-A) with #10 x 1¼-in. *rh* screws, locating bearing blocks as dimensioned in Fig. 2-K. A 1/32-in. thick felt washer is necessary between crosshead and bronze bearing on connecting rod to supply oil to bearing (Fig. 2-F). Put a drop of oil here before every saw job or oftener. To lubricate plunger and crosshead guide, use powdered graphite frequently.

Saw blades are pieces of bandsaw blades ground as shown in Fig. 2-L.

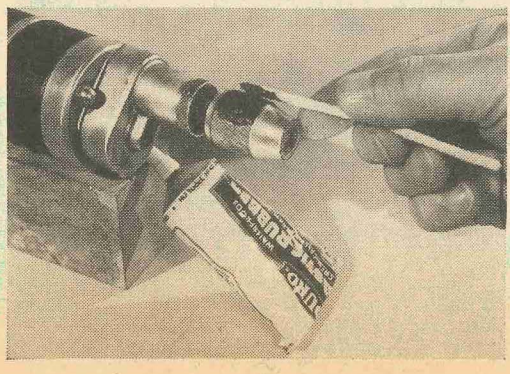
If steel tubing with thicker walls than .025 in. is used for plunger, increase counterweight by adding steel washers secured by counterweight bolt.

Removing Outdoor Rust Stains

• To remove rust from a cement patio or stains on siding caused by rusty nails, dissolve 1 part sodium citrate in 6 parts water, add 6 parts glycerine. Mix with powdered whiting to form a heavy paste. Spread a thick coating of the mixture on the stained area and allow to dry. Repeat treatment if necessary. Badly stained areas may require a week or more for complete removal.

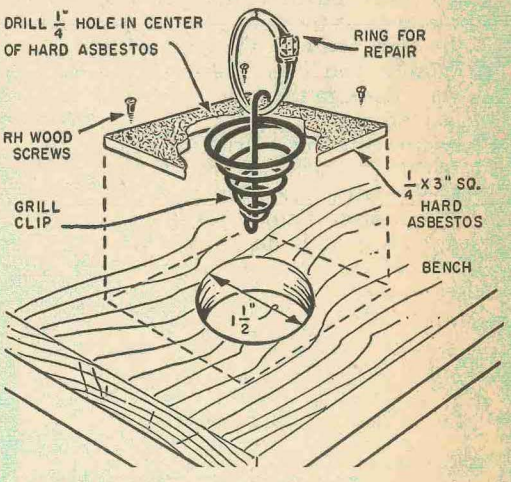
Plastic Rubber Improves Chuck Grip

• If you find that the light knurling on the chuck of your drill makes it hard to get a good grip on large bits, coat the chuck with plastic rubber. The coating dries overnight, and provides a non-slip finger grip.—K. MURRAY.



Grill Clip Clamps Small Parts

• This method of clamping rings to the bench while soldering and setting stones was used successfully by a jeweler, but it can be adapted to many other light soldering and assembly jobs. To make this heat-proof holder,

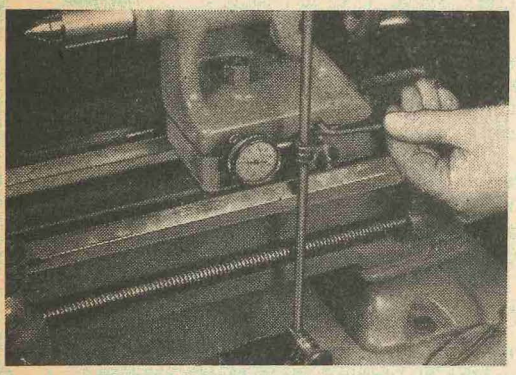


drill a ¼-in. hole in a piece of hard asbestos board. Mount it centered over a 1½-in. hole bored through the bench top. The hook of the radiator clip protruding through the top firmly grips rings, and other small items. Work can be done at any point with both hands free to handle tools.—G. S. WILHITE.

SHOP KINKS

Gaging Tailstock Set-Over

• When you offset your lathe tailstock for taper work, use this method for making a

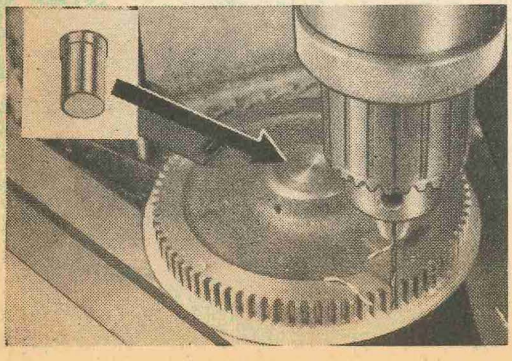


precise set-over quickly. Set up a dial indicator as shown, and it will indicate tailstock movement directly in thousandths of an inch. Mount the indicator on a surface gage, or use a clamp to prevent slippage.—H. J. GERBER.

Gears Space Radial Holes

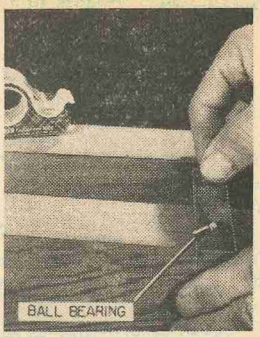
• A lathe gear makes an excellent emergency drill press jig for spacing radially divided holes. Note how the 80-tooth spur gear is used to locate 20 holes in an aluminum disc. The small drill which just fits is nested between every fourth tooth space around the circumference of the spur gear. If you make sure the drill contacts the sides of the gear teeth closely, you'll get precise results. The drill won't damage the gear, since the cutting edges are on the point only.

To insure concentric drilled holes, make a plug which fits tightly through the center hole of the lathe gear and the work piece, and clamp both tightly together. Change gears from a small lathe will give you a wide range of diameters and tooth spacings.— H. J. GERBER.



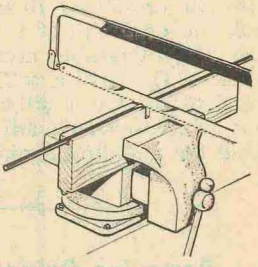
BB Matches Dowel Holes

• To mark two pieces of wood for exactly matching dowel holes, tape a BB to one in the desired place. Then hold the two pieces together in alignment and tap with a mallet. A slight depression mark on each piece of wood will indicate the precise location for drilling dowel holes.—BARBARA LANG.



Grooved Lumber Holds Rods

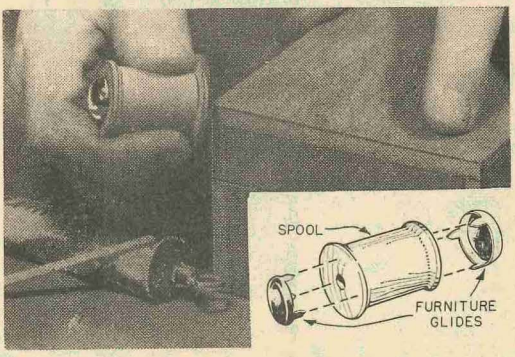
• Place a piece of tongue and groove lumber in your vise to hold the work when you are hacksawing small rods and tubing. You can save the time it would take to clamp each piece, and marks from vise jaws are eliminated.



A slot sawed in the edge of the groove will guide the blade vertically (or even at an angle) enabling you to cut duplicate pieces accurately.—G. E. HENDRICKSON.

Spool Makes Smoothing Tool

• Drive two common furniture glides into the ends of a spool to make this handy desk and workbench tool. Preferably one glide should be larger than the other. The smooth dome-shaped metal surfaces are ideal for



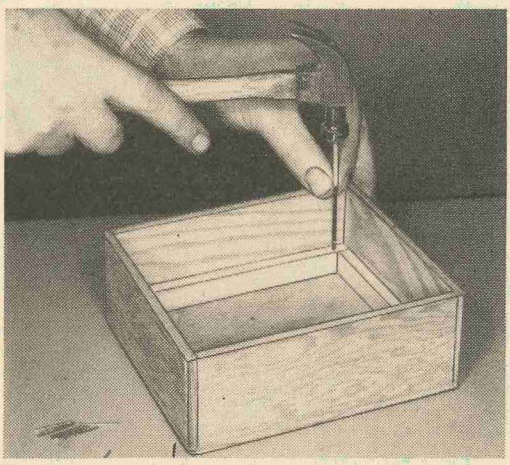
rubbing glued joints into good contact, and for smoothing rough spots on metal, lacquer, and plastics. In your darkroom, use it for pressing edges of prints into contact with ferrotype plates. At your desk, use it to make sharp creases in thin papers, and to smooth paper after erasing.—W. E. BURTON.

Magnet Holds Brads

• Instead of picking brads out of small containers one at a time with the fingers, use a common horseshoe magnet. You can salvage one from an old radio speaker. The magnet holds brads ready for handy nailing work on the bench, and tends to prevent pricking the fingers. Also, when you are cleaning your brad bins, use the magnet to lift the brads while blowing or brushing out dust.—G. E. HENDRICKSON.

Driving Brads in Tight Spots

• You can drive brads in hard-to-reach inside corners of boxes and drawers with this holder made of tubing and a finishing nail. Get an old ball-point pen, and cut off about 2 in. of the hollow metal center which serves

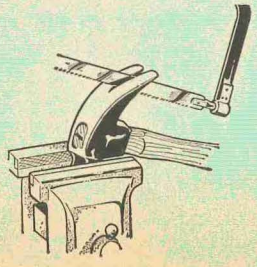


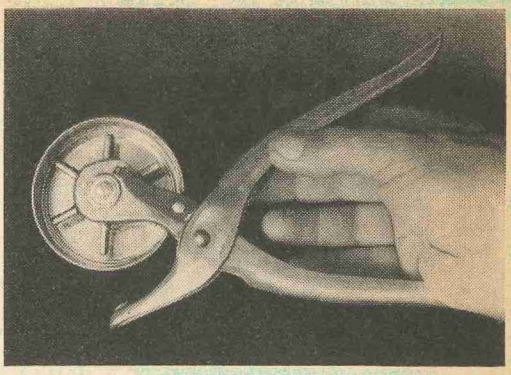
as its ink reservoir. Clean the ink from the inside with a pipe cleaner dipped in "Energine," or any similar household spot remover. (Work carefully since the ink is very difficult to remove from the fingers.)

Then, make the brad driver by grinding off the point of a finishing nail. To use the holder, place it at the desired spot; drop in a brad which slides freely in the tube, and drive it home with the brad driver.—FRANK HEGEMEYER.

Hacksaw Renews Hammer's Claw

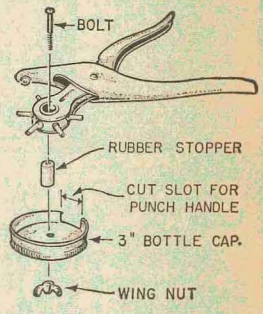
• After a hammer has pulled quite a few nails, the slot between the claws often becomes so badly worn that the heads of small nails can slip right through. To restore the hammer's pull, just hacksaw the slot a little deeper as shown.—JOHN A. COMSTOCK.





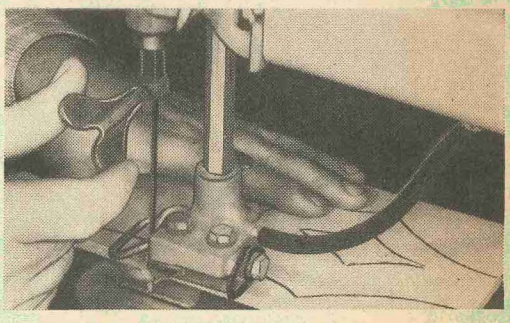
Capping the Punch

• With this cover made from a 3-in. bottle cap, you can protect the easily nicked cutting edges of your leather punch. Cut a slot in the side wall of the cap for the handle, and drill a hole in the center for the bolt. This bolt and wing nut hold a rubber stopper which just fits snugly into the center hole of the turret. With the wing nut loose, the rubber portion slips through the hole easily. Tighten the nut a few turns, and the rubber will expand, holding your shield firmly in place.—A. ZANELLI.



Spoke Key Tightens Saw Chucks

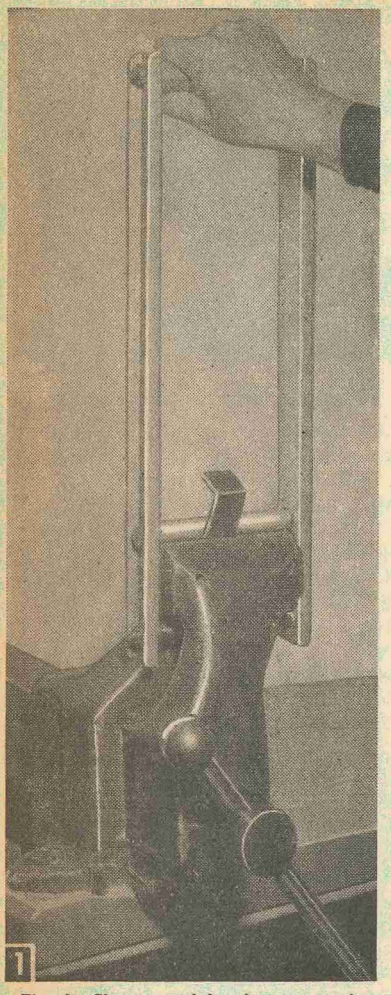
• If your scroll saw has small thumb screws on the upper and lower chucks, you may find that the blades often work loose, because it is difficult to tighten the screws sufficiently by



hand. An ordinary bike wheel spoke key provides the right leverage to hold the blades securely. Drill a hole in the key and you can attach it to your machine with a cord, to keep it handy.

Do not tighten the thumb screws so much that they will strip the threads. Just a light extra turn will do it.—FRANK HEGEMEYER.

Sheet Metal Bender



MATERIALS LIST—
SHEET METAL BENDER

No.	Size and Material
2	1/4 or 3/8 x 1 x 18 x 30" (see text) steel bars
2	3/8" I.D. x 4 1/4" pipe
1	5/8" O.D. x 6" steel bar
2	3/8-16 x 5" machine bolts

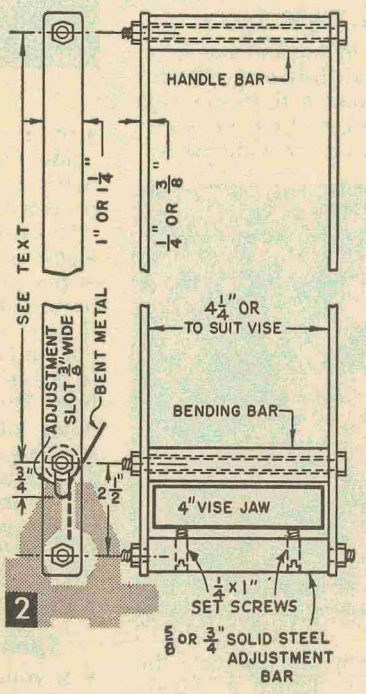


Fig. 1. Sheet metal bender mounts in machinist's vise and adjusts for making sharp or easy bends.

BENDING metal straps and sheet metal parts over the jaws of a vise with a hammer leaves a rough, irregular job, so I devised a lever bender that forms the strips over the vise jaws evenly and quickly.

To make metal bends, place the lower, solid steel cross-bar (with its adjusting screws) below the vise jaw (Fig. 3). Then, the metal strip is clamped in the vise with the marked line along the top edge of the jaw and the bending crossbar back of the strip. Pulling the handle bar towards you, bend the strip to any angle you choose up to 90°. How sharp the bend is depends on how lower set screws are adjusted — sharp bends result when the upper bending cross-bar is close to the top surface of vise; larger radius bends result when cross-bar is farther above the vise.

Bender shown in Fig. 2 has 18-in. side bars for bending leverage ample to bend 1/32-in. steel or up to 3/32-in. aluminum. For bending band iron up to 1/8 x 1 in., extend side bars to 30 in. Even then, you won't be able to get extra sharp bends.

Slots in side bars (Fig. 2) may be needed for use on small vises in order to bring bars close enough together. Clamp side bars together when drilling holes alike to keep cross-bars true and parallel.

If you have no lathe facilities for making the solid steel adjusting bar with set screws, simply make cross-bars from pipe with bolts through centers. Make adjustments for average work in slots.—CARL S. BATES.

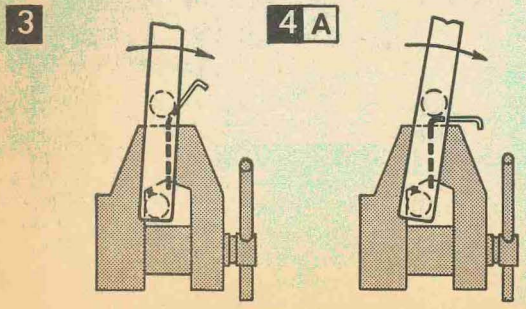


Fig. 3. Benders can be stopped for angles less than 90°. one side first (A), slip metal up and make second bend.

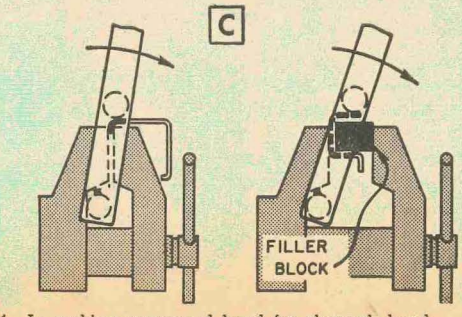
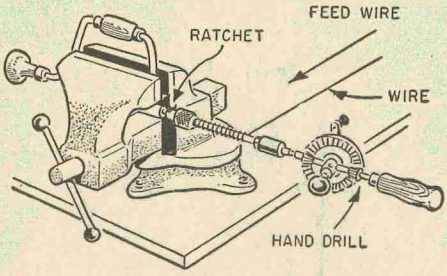


Fig. 4. In making compound bend for channel, bend (B), Use metal or hardwood block for compound bends or to gage channels for uniform size (C).

Wind Better Coils with Ratchet

• Ever wind coils or springs with a dowel and hand drill? Then you know it takes steady pressure on the winding knob without letting up for an instant. Here's a better setup. Chuck the opposite end of the dowel



in a ratchet brace mounted in your bench vise. Set the ratchet so it moves only in the direction of winding to prevent backlash. With larger sizes of wire, you'll need a helper to feed the wire.—R. MOORE.

Washer Lifts Tape End

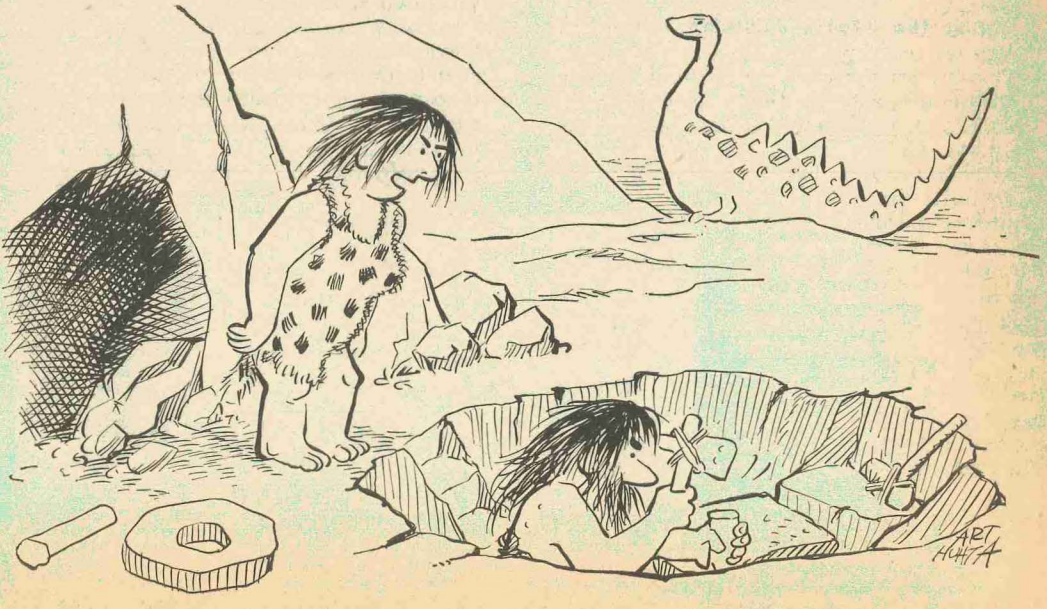
• No need to bust a fingernail and your temper lifting up a stuck-down end on a roll of tape. Just slip a washer or coin under the tape end each time you use it. End lifts easily when needed.—F.A.J.

Small Parts Box

• Screws, bolts, other small parts that are used on the job can clutter up the tool box. Save yourself time and trouble, as well as give your tool box a neat, workmanlike look by using ordinary plastic cigaret cases of the type shown to carry the needed parts. Added bonus: by using clear plastic boxes, you can also tell at a glance what needs to be replenished.—F.A.J.

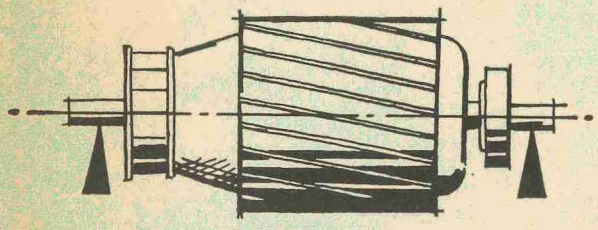
Benchtop "Hot Plate"

• Nail a scrap of leftover asbestos shingle at a strategic spot on your bench top. You now have a place on which to set a hot glue pot, lay down a warm soldering iron or any other hot object.



You think more of your basement workshop than you do of me!

Static Balance Test Stand



By HAROLD P. STRAND

With this adjustable static balance stand, you can correct the balance of motor armatures such as this rotor from a 1/3rd *hp* induction motor, as well as machine parts, mandrels, spindles and shafts.

MODEL engine builders, and electric motor and car generator repairmen will find the static balancing stand a must for accurately balancing motors, armatures and other machine parts to reduce vibration at high speed.

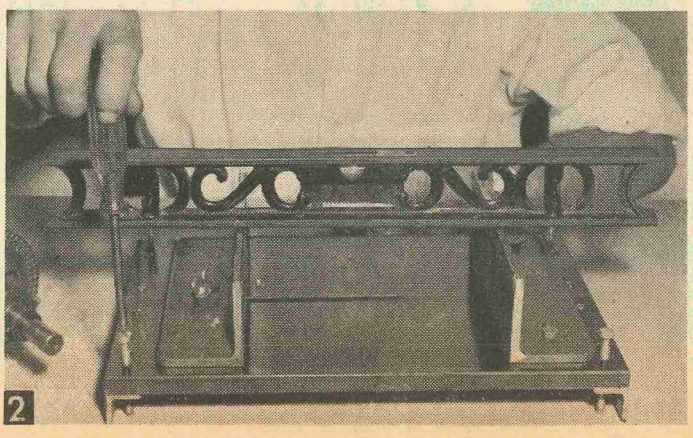
The knife edge parallel ways will swing parts up to 5 inches in diameter, and the span between is adjustable from 1 to 7¾-in.

Of course, both dynamic (in motion) as well as static (at rest) balance must be considered to eliminate trouble from vibration in rotating machine parts. But since dynamic balancing equipment is too expensive for the small shop to consider, a good job of balancing can be done with this static balancing stand by following the fundamentals of dynamic balancing as described later in this article. To start, here's how to build the test stand.

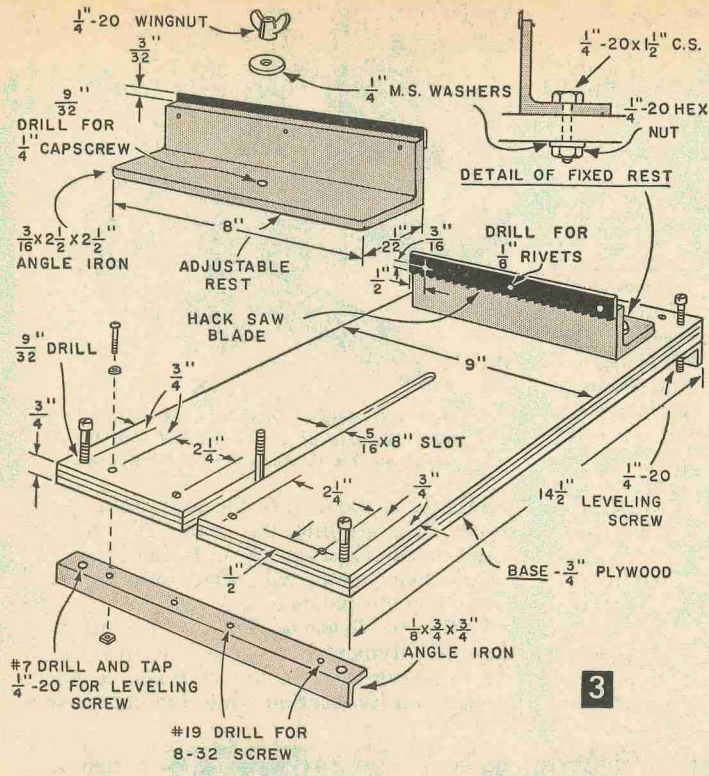
Building the Static Balancing Stand. Although we used two ½ x 4½ x 14½-in. pieces of Bakelite for the base of the stand, you can substitute a ¾ x 9 x 14½-in. piece of plywood, as in Fig. 3, if Bakelite is not conveniently available. Cut the slot in the plywood base first. Then make up the ¾ x ¾-in. reinforcing angle irons that bolt to the bottom of the base (Fig. 3). Dress the sharp corners at the ends with a file and lay out and drill the six holes in each piece. Before tapping the #7 drilled holes at the ends, align and clamp the angles to the underside of the base and continue drilling the holes through the base. Then remove the angles and tap #7 holes, ¼-in.-20 thread.

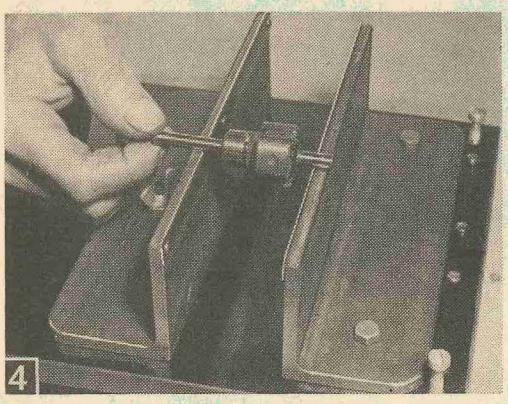
Now cut the 2½ x 2½-in. angle iron to 8-in. lengths and dress the sharp edges with a file. Lay out and drill the 9/32-in. holes for fastening to the base. Note in Fig. 3 that the fixed rest has two ¼-in. holes while the adjustable rest has only one ¼-in. hole.

Hacksaw blades, ground to a knife edge and riveted to the fixed and adjustable rests are used to make the smooth friction-free ways on which you balance the machine parts. Use 10 or 12-in. Simonds hacksaw blades. They are not hardened their entire length and are



First, use the corner screws to level in the direction of the knife edges. Then adjust from side to side with the level balanced across the knife edges.

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Move the adjustable rest inward and you can balance small parts such as this tiny armature from an electric hand tool.

soft enough to drill. Cut the blades to 8-in. lengths by gripping in a vise and bending back and forth at the line of cut. Then grind the set in the teeth flush with the sides, and also grind or file a 45° knife edge along the back edge of the blades. This edge should not be ground to a point of sharpness, since it must be absolutely flat, without any waves, dips or nicks. Then drill the three 1/8-in. holes in each blade as in Fig. 3.

Fastening the blades to the angle iron rests parallel to the bottom surface is the most critical job in building this stand. First fasten each blade to the rests with three small clamps so that the knife edges are 3/32-in. above the edge of the rests as in Fig. 3. Then use a caliper to check the 2 19/32-in. distance from the knife edges to the bottom of the angles at the ends and middle of the blade. Tap the blade up or down to make it parallel with the bottom of the angles. Then drill the 1/8-in. holes in the saw blades through the angle iron. Insert 1/8-in. rivets in the holes and peen the ends. Assemble the parts as in Fig. 3. Round the ends of four 1/4-20 screws to make the leveling screws which thread into the angle at each corner.

Leveling the Test Stand. Place the completed test stand on a solid bench, preferably where it can remain undisturbed. The ways must be perfectly level, so avoid making your setup in a place where there is vibration, or where the floor is not perfectly firm. First gently rest your level on each of the knife edges and adjust the corner screws until the bubble centers. Then place the level across the two knife edges as in Fig. 2, and again adjust the screws. You may have to make a minor change in the first adjustment to get the final setting. If you find that one of your rests is not perfectly parallel to the base, you can correct slight error by placing a shim of thin sheet metal between one of the screws of the fixed rest and the base.

Making Static Balance Adjustments. To test a rotor, simply place it on the ways as in Fig. 1. Be sure to handle the part gently so as not to nick your knife edges. Also use a part of the rotor shaft that is perfectly clean and free of marks or bearing wear. Nudge the rotor slightly allowing it to roll to a rest (Fig. 4). Mark it on top with a crayon, and repeat the test several times. If the rotor is statically balanced, it will come to rest at a different point each time. However, if it is not in balance, it will repeatedly come to rest at a certain position with the heavier side at the bottom.

Fig. 4 shows a rotor from a small electric hand tool. The manufacturer has drilled out some metal from one of the poles to remove weight from the heavy side. If you plug in a motor and run it without load, and it tends to "walk" on the bench, or if you can feel excessive vibration through the case it indicates

imbalance. The rotor in Fig. 5 is from an old motor, and was found to be badly out of balance. Heavy wire solder was clamped into the holes of the ventilating fan on the light side, which repeatedly came to a rest on top when tested. The solder must be crimped tightly. After adding the weight correction, repeat the test on your stand. Sometimes, you will need to add weight at several places.

Some rotors, such as the one in Fig. 6, include an arm with lead weights which is used to counterbalance the cutout switch assembly on the opposite side of the shaft. You can use a file, or a pointer to adjust the lead weights for better balance. A larger rotor (Fig. 7), can often be balanced by drilling out some of the core metal on the heavy side. However, proceed slowly and avoid drilling so deeply that the rotor structure is weakened.

Small wound armatures (Fig. 8) can be balanced by adding brass strips which you can hammer in on the light side of the rotor. If pairs of fiber sticks were used in the armature slots, you can make space by driving one out. This method can be used only if two insulating top sticks are used since you could not replace a single top stick with brass without shorting the windings. With a new winding before varnish has hardened, this method can be used; afterward it may be impossible to get any added material in the slots.

Another method (Fig. 9) is to drill iron out of the core teeth, thus lightening the heavy side of the rotor. Avoid drilling more than 1/16" deep on the average to keep within the limits of the iron in the tooth so as not to break through into the coils. A few such small holes drilled on the outside of the rotor on the heavy side will often bring a motor into complete balance.

Repeated tests showed that this rotor was light on one side. Weights of solder pressed into the fan holes on this side corrected the balance.

Static vs. Dynamic Balance. In modern factories, dynamic balancing machines show the inspector the amount of metal to be removed and its location while the part is spin-

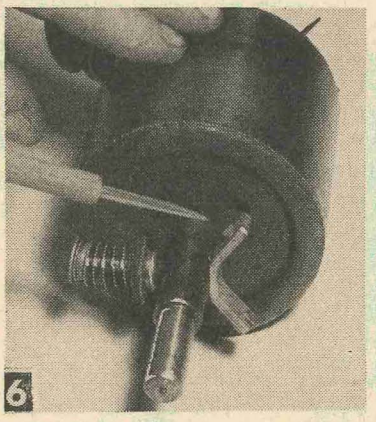


Fig. 6. The weight of this control switch mechanism is balanced by lead weights. Adjusting them, or adding lead brings the rotor into balance.

Fig. 7. Sometimes you can balance this type of rotor by drilling metal out of the core on the heavy side. Do not drill deep enough to damage the structure.

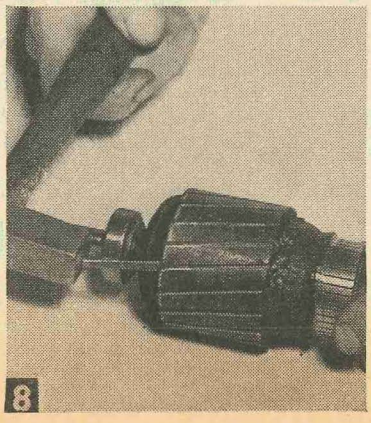


Fig. 8. Before varnishing, you can balance a newly wound armature by driving out one of the two top fiber strips and replacing it with a brass strip.

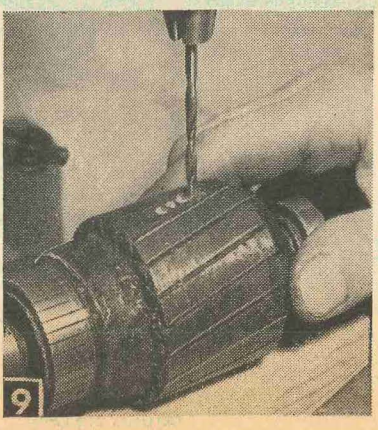


Fig. 9. You can balance wound armatures by drilling out metal from the side which tests heavy. Take care to avoid damaging the winding beneath.

ning at actual operating *rpm*. While your test stand indicates only the static balance of parts at rest, you can, however, apply dynamic principles when you make your own weight adjustments.

MATERIALS LIST—STATIC BALANCE TEST STAND

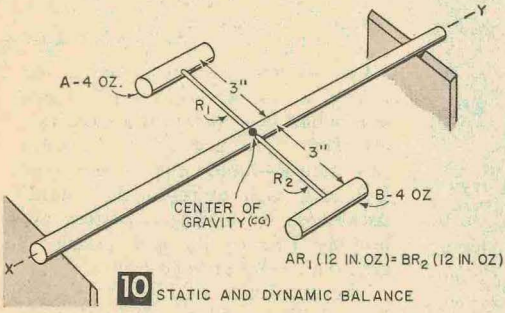
No. Req.	Size and Description	Use
1	3/4 x 9 x 14 1/2" plywood (or 2 pcs. 1/2 x 4 1/2 x 14 1/2" Bakelite)	base
2	1/8 x 3/4 x 3/4 x 9" angle iron	base supports
2	3/16 x 2 1/2 x 2 1/2 x 8" angle iron	rests
2	10 or 12" hacksaw blades, semi-soft. Simonds or equal	knife edges
8	8-32 x 1 1/4" *rh* machine screws with nuts and washers	
4	1/4"-20 x 2 1/4" fillister hd. machine screws	leveling screws
3	1/4 x 20 x 1 1/2" hex-head cap screws	rest mtg.
2	1/4" x 20 hex nuts	rest mtg.
1	1/4" x 20 wing nut	rest mtg.
4	1/4" washers	knife edge mtg.
6	1/8" x 3/8" round hd iron rivets	knife edge mtg.

For example, let's suppose that weights A and B (Fig. 10) are equal and are held to the shaft by two equal arms, R1 and R2. These arms are mounted in a straight line vertical to axis XY of the shaft. This pair of weights is termed a *force couple*. Because $R_1 \times A = R_2 \times B$, and they are located in the same plane, the structure is in static and dynamic balance with the center of gravity, (CG) in the middle.

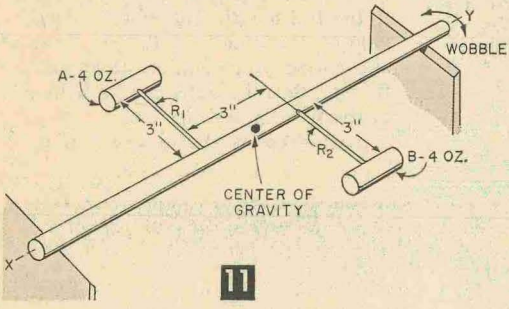
Now let's move one of the arms down the shaft 3 in. (Fig. 11). Multiplying the arms and weights gives us the same figure in inch-ounces, and the structure is in static balance on the knife edges. But the center of gravity is no longer on the axis of both arms, and therefore the ends of the shaft tend to wobble, or vibrate.

You can cure the trouble by adding weights shown in Fig. 12. A and B are the same as before, but C and D have been added. All weights are in the same plane, vertical to the axis XY, with the center of gravity at CG. Our mechanism is again in both dynamic and static balance.

When you work on motors, lathes and other high speed mechanisms, it is important to remember that dynamic balance must be more perfect as you increase speed. For example, dynamic imbalance at 1000 *rpm* is doubled at 2000 *rpm*.



10 STATIC AND DYNAMIC BALANCE



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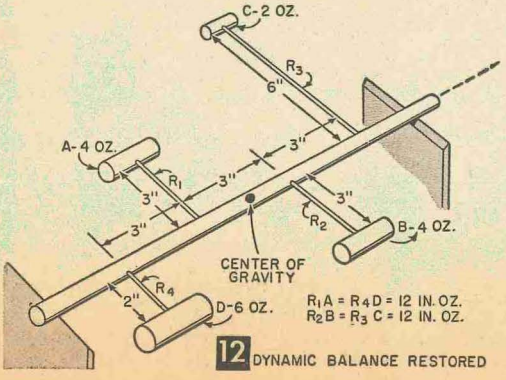
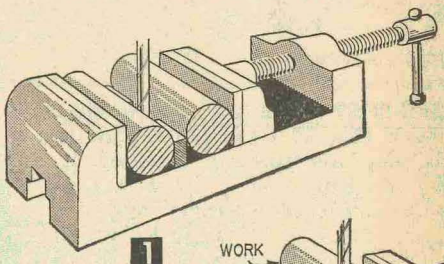


12 DYNAMIC BALANCE RESTORED

Improvised V-Block Centers Drill Bit for Round Stock

To cross-drill round work through its exact center on a drill press, clamp two flat steel blocks, of the same thickness as the diameter of the drill, between two short lengths of round bar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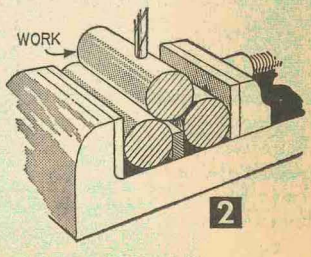

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stock, thus improvising a V-block as in Fig. 1. Center the drill by lowering it between the bar stock and clamp the vise to the drill press table. Place the work on the V-block, Fig. 2, and drill the hole.—C. W. Woodson.

Versatile Floor Stands

provide extra "hands" for woodworkers

Support stand clamps onto and moves with the work, enabling you to trim ½-in. pieces from full 4 x 8-ft. panels—without hollering for help. If basement floor slopes steeply for drainage, place table saw so it cuts in direction of slope.

A SUPPORT stand that *travels* with the work (Fig. 1) takes the struggle out of sawing large sheets of plywood. It also enables you to cut expensive plywoods without marring surfaces or edges—something which frequently happens with ordinary extension fences.

With it, you no longer have to call on your wife or a neighbor to help hold the work, or else run the wobbly risk of tackling the job alone.

I have found it easy to trim as little as ½-inch from the long side of a 4 x 8-ft. panel, using this stand. And simply turning the stand upside down, as in Fig. 2, works well in providing supplementary roller support on certain jobs.

You can make the support stand either fixed (as in Fig. 3) or adjustable (as in Fig. 4). For either design, the casters you use *must* be of a good, ball bearing type which will turn freely and rotate smoothly. To make sure you allow the correct height for the casters, temporarily set a caster in a piece of scrap wood. Then measure from the surface of the wood to the bottom of the wheel.

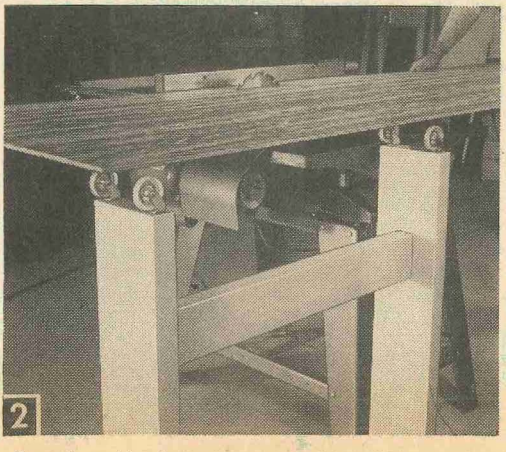
After parts are cut to size according to dimensions shown in Fig. 3 or Fig. 4, you can assemble them with glue and nails. You can use a router bit to make the slots in the adjustable stand, or drill ⅜-in. holes at each end of the slot, and then drill overlapping holes between. Then clean out slot by moving work back and forth as drill is turning. Or use a hand file.

Cabinet Stand with Pivot Jig. Figure 5 shows you another support stand design. This one incorporates a pivot jig you'll find useful when cutting and sanding large circular pieces.

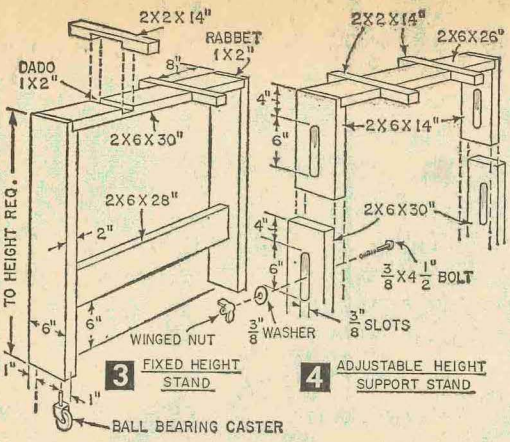
Casters may also be added to this design, as in Fig. 6, to provide support when you are sawing wide panels. Note the perforated Masonite side panels—handy for storing tools. You can also increase the stand's usefulness by adding a bottom and hinging one of its end panels to create an extra storage cabinet.

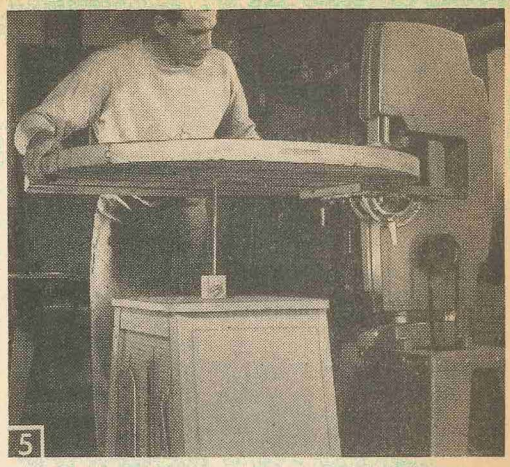
The leg dimensions shown in Fig. 7 are deliberately oversize. Cut them to the full length and, when finished, trim off the bottom of the legs to the exact size you require. Remember, though, that the extra length belongs at the bottom, not the top.

Note grooves cut in the legs and



Turned upside down, same stand provides two or four casters which help support work.





Adjustable locking pivot rod eases job of circular cutting or sanding.

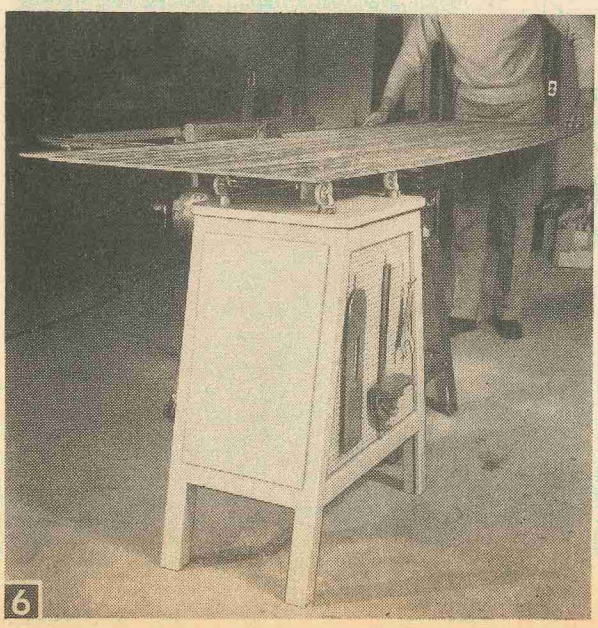
horizontal cross braces, to accommodate perforated Masonite sides. Cut the Masonite after temporarily assembling the frame pieces, so that the Masonite panels will fit correctly. Then assemble leg and side cross-brace frame pieces, with Masonite panels in place, using glue and corrugated fasteners. Next, assemble sides together with the cross-brace end frames. Cut out and rabbet the end panels along all four edges, and attach them with glue and 1-in. finishing nails.

To make sure holder for pivot rod is mounted correctly on the cabinet top (Fig. 7), drill the hole through the holder, then center holder exactly on top of cabinet and glue and nail it in place (driving nails from the underside into the top). The hole drilled in the holder then becomes your guide for drilling a matching hole through the cabinet top.

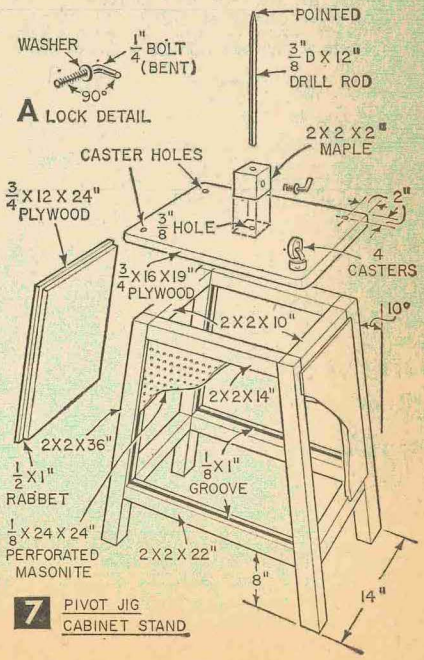
The lock screw hole in the block will have to be tapped to take a ¼ in. bolt which is turned to secure the pivot drill rod. Point the top of the rod by grinding or sanding.

Nail the top in place. Then drill the holes for the casters. The lock (A in Fig. 7), is a bolt bent 90° just beyond the threaded portion. You can secure a washer at that point by first peening the washer around the hole to make it smaller, and then forcing it onto the bolt before it is bent. Remove the bolt head by hack-sawing.

When doing pivot cutting with the stand, be sure pivot is exactly the height of the tool table, and that it is lined up with the cutting edge of the blade.—R. J. DeCristoforo.



Casters may be added to cabinet stand to provide work support.

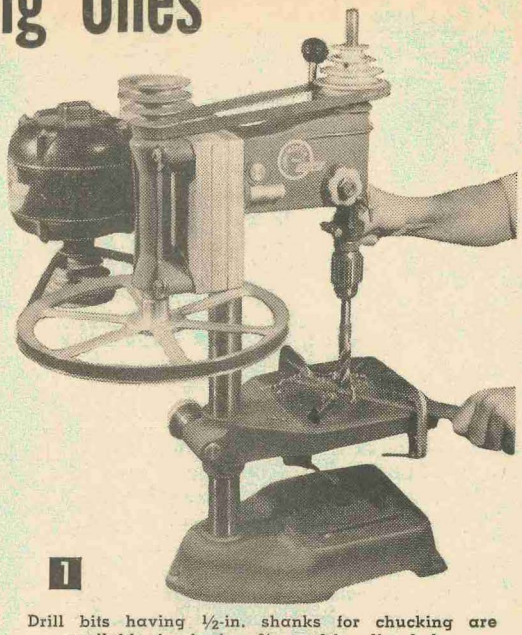


How to Bore the Big Ones

THERE'S a secret to boring up to 1-in. dia. holes through steel with a ½-in. capacity drill press. You reduce the speed of the drill bit and increase the torque with a speed-reducer.

The speed-reducer is simply a jack-shaft consisting of a mandrel with a 4-step cone pulley on one end and a 12-in. pulley on the the other end as in Fig. 1. This reduces the drill press chuck speed to a low of about 125 *rpm* and a high of about 600 *rpm,* depending on how the cone pulleys are belted.

Cut the mounting board and spacers to size as given in Fig. 2 and the Materials List, and bolt the assembled mandrel and pulleys to the mounting board with the spacers under the mandrel. The spacers are needed to provide clearance between the drill press post and the 12-in. pulley. Then remove the motor from the drill press and temporarily fasten the mounting board to the motor bracket with c-clamps. Hold a straightedge across the two cone pulleys and align them by repositioning the mounting board so that the V-belt will run true. Mark the location of the slotted bolt holes in the motor bracket on the mounting board, remove the board and drill the 11/32-in. holes, countersinking them on the side the mandrel is fastened.

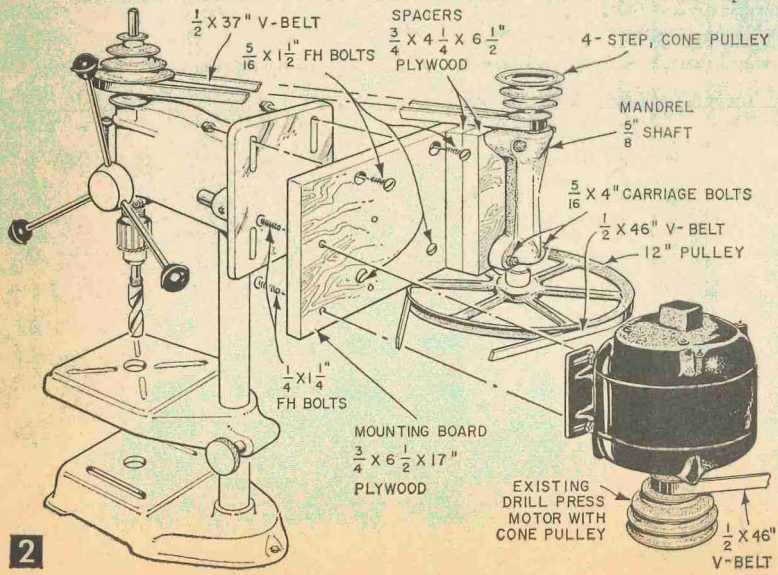


1

Drill bits having ½-in. shanks for chucking are available for boring 5/16 to 1-in. dia. holes.

MATERIALS LIST—DRILL SPEED-REDUCER

No. Req.	Size and Description	Use
1	¾ x 6½ x 17" plywood	mounting board
2	¾ x 4¼ x 6½" plywood	spacers
1	½ x 37" V-belt	drill press pulley
1	½ x 46" V-belt	motor pulley
4	5/16 x 4" carriage bolts	mandrel
4	5/16 x 1½" fh bolts	mounting board
4	¼ x 1¼" fh bolts	motor
	(the following parts made by Chicago Die Casting, available from your local hardware store)	
1	#1560, ⅝" shaft dia. ball bearing mandrel	
1	#140, 4-step, V-grooved, ⅝" bore step pulley	
1	#1200A ⅝" bore x 12" dia. V-grooved pulley	



2

Now, place the motor on the board so that a 46-in. long V-belt will go around the 12-in. pulley and the smallest pulley on the motor cone pulley. Align the pulleys, and mark and drill the board for motor mounting bolts. Countersink these holes and bolt the motor to the board.

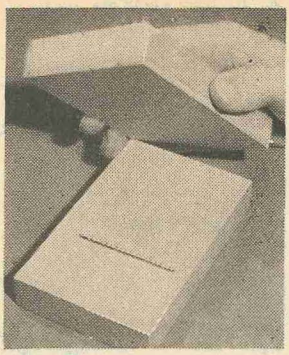
Since the motor must be turned upside down from its normal operating position, it will have to be reversed. Remove the plate covering the electrical connections and change the wiring as noted on the diagram on the back of the cover plate.

If your drill press motor has a double ended shaft, it will not have to be reversed. Simply use it in its normal position and place a 2-in. pulley on the lower end of the motor shaft to drive the 12-in. pulley.

When boring a hole, start with a ⅜-in. drill bit and enlarge the hole with ⅛-in. larger drill bits until the required size is reached.—ART YOUNGQUIST.

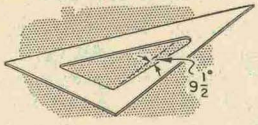
SHOP KINKS

Wood Blocks Restore Bent Drill



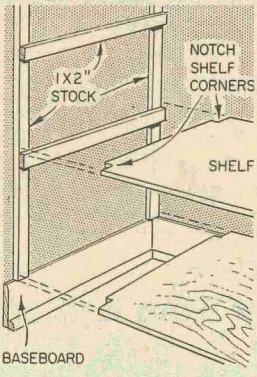
• Small diameter drills used in a hand-held drill often get bent out of true. When this happens, restore the bent drill by rolling it back and forth a few times between two blocks of scrap hardwood.—FRANK A. JAVOR.

Time-Saving Triangle Alteration



• Draftsmen and designers who do a lot of work with I-beams, channel iron and other structural shapes will find that slightly altering one of their triangles will greatly speed up the drawing of these sections. Since the standard flange taper is 2 in. per foot or approximately 9½°, cut out the inside of the triangle to this angle. The regular operation of the triangle is not affected, but the simple change saves time and helps make a neat job when using triangle for structural work.—ROGER ISETTS.

Portable Closet Shelves



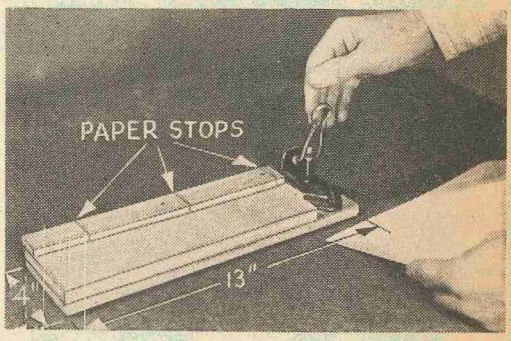
• If you need more space in a clothes-closet but don't want to disfigure the walls by nailing cleats to them, make these portable shelves.

From 1 x 2's build twin "ladders," spacing the crossbars at proper distances for shelves. Cut the two front uprights a bit longer than the back uprights. This will cause a slight slant to the rear to offset any tendency to tip forward.

Stand the "ladders" atop the baseboard, then cut the shelves for a tight fit across the width of the closet, notching the corners for the uprights. By tapping the shelves into place, the entire assembly is wedged tight between the side walls, substantial enough for storage purposes. Rest the bottom shelf on the baseboard. This assembly saves time when cleaning or repainting the closet, too, because it's a simple matter to remove the shelving.—BEN S. BALDWIN.

Single Punch Multiplies Holes

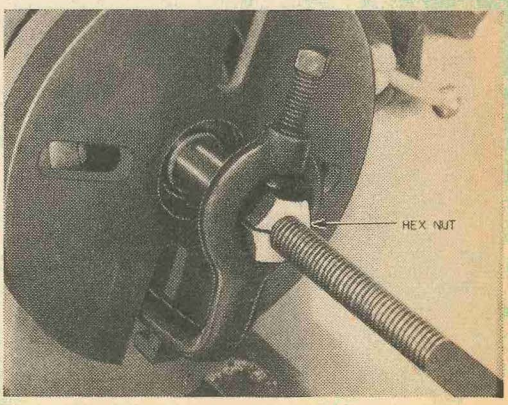
• A single-hole paper punch can be used to do accurate multiple-hole punching by attaching it to a simple gaged table. Make base of two pieces of ½-in. plywood screwed together from the bottom side. Cut out top piece to take paper punch, which is then



screwed to bottom piece. Screw a ¼-in. strip of plywood along back edge of base and space lines to use as paper stops so the holes for two or three ring binders can be punched out easily in accurate locations. Any series of hole punchings can be marked out on the gage and identified by different color lines. Drill a hole in the base board, centered directly under the cutting die, for ejecting the scraps of paper punched out.—MICHAEL LIGOCKI.

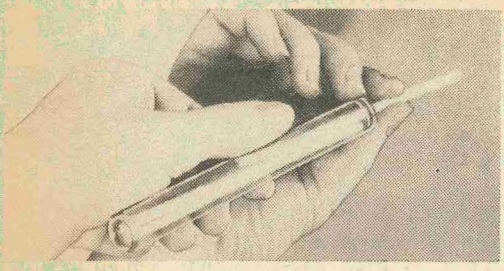
Hex Nuts Clamp Threaded Work

• Use an ordinary hex nut, cut through on one side with a hacksaw, to clamp threaded



work in the lathe without marring the threads. Fit the lathe dog on the nut so the clamping screw pressure closes the slot in the nut, securely holding the threaded work piece.—R. HANSCOM.

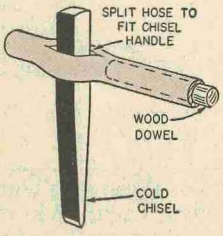
Drill Case Keeps Cleaners Clean



• Shop pipe cleaners used for cleaning out apertures, openings and the like won't do the job if they themselves aren't clean. Keep them that way before use by storing them in the long, plastic screw or snap-top container that drill bits are sold in.—F. A. J.

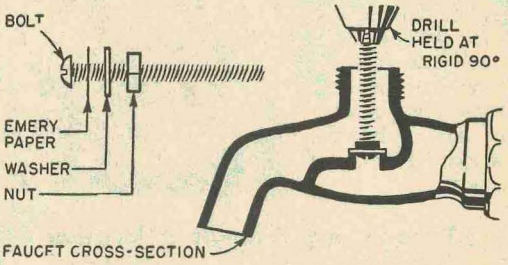
Chisel Holder Protects Hands

• A cold chisel holder made of a length of garden hose will protect your hands from glancing blows. Cut a 2-in. slot near one end of a 15-in. piece of the rubber hose, to fit the chisel handle. Then fit a length of wood dowel into the long end of the hose to serve as a rigid handle.—H. E. Moody.



Re-Seating Leaky Faucet

• When re-seating water faucets in the home, a simple bolt assembly may be used to avoid the expense of purchasing a seat reamer. On a long stove bolt fit a disc of emery paper cut to washer size, a washer and a nut as shown in sketch. Place assembled stove bolt in a hand drill and

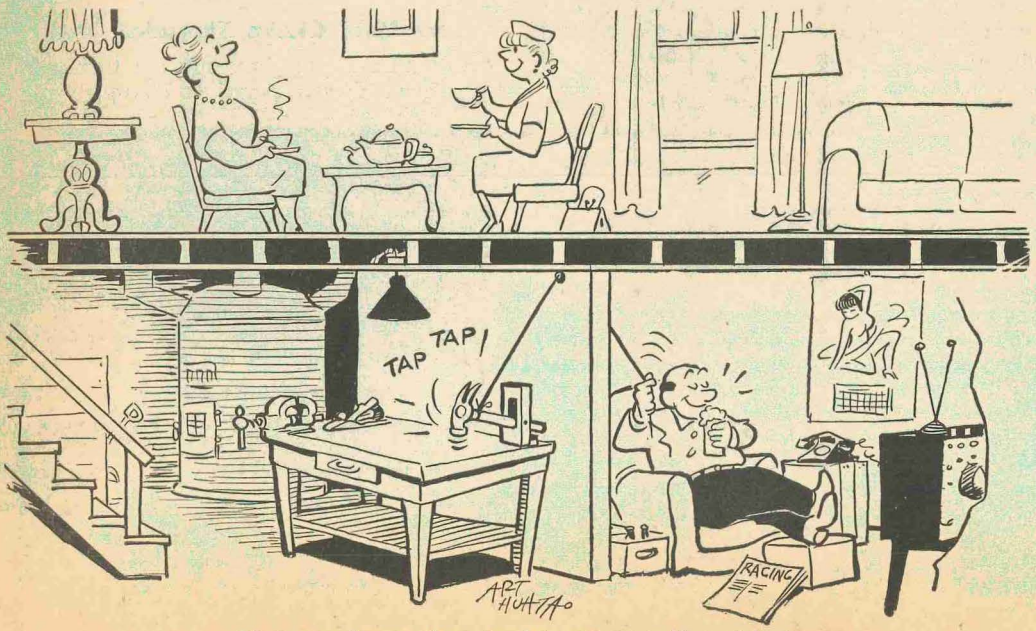


allow to rest lightly on the valve seat of the faucet. Hold drill vertically and turn to smooth surface of rough valve seat. Faucet will not leak and will not wear out the rubber washer as quickly.

If different types of faucets are encountered in the home, merely substitute a different-sized washer and emery paper to fit each faucet-seat.—Daniel J. Pry.

Keep Shop Tape Fresh

• Friction and other shop tape get all gunky from the grit and dust in every shop drawer? You can keep it clean and fresh down to the very end if you wrap the roll in a bit of kitchen plastic whenever you are through using it.—Frank A. Javor.



John's never happier than when he's puttering in his workshop!

TOOLS FROM OLD NAIL SETS

By WALTER E. BURTON

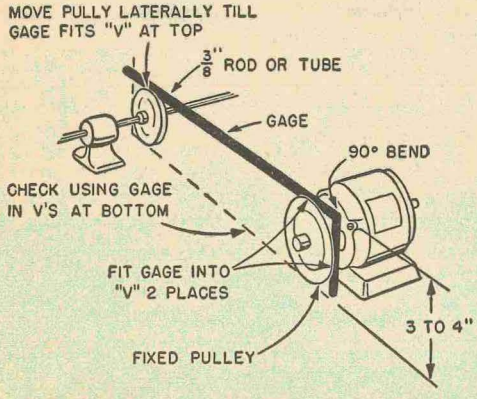
Fig. 1. A punch with special tip is used to make a decorative border on a brass wall bracket. The end of punch was first ground flat, then shaped by making two shallow crossed cuts with a triangular file.

A WORN out or broken nail set need not be discarded. With a little grinding, filing and polishing, it can be converted into a special punch, chisel, leather-embossing or art-metal tool. If grinding is carefully done, so as not to overheat the metal enough to disturb seriously its original hardness, the tool should need no heat treatment. However, if the hardness of the steel is disturbed by grinding, it is easily restored by hardening and tempering as for any high-carbon steel. While grinding new points, remove any burrs caused by mushrooming of nail set head.

Some nail set tips are soft enough to be shaped by filing; if not, anneal by heating steel slowly until cherry-red in room light, then bury it in ashes or sand to cool slowly. After filing and polishing with an abrasive cloth, reharden nail set by heating again to a cherry-red color. Swiftly stick tool point-first into cold water. If properly hardened, the steel will resist file bite. However, as it is too brittle in this state to be used for punches and chisels, temper or draw tool by first polishing hardened portion, then reheating slowly. If torch is used, direct flame near, but not directly on, cutting edge or point. When polished area shows brown color close to cutting edge or point, dunk tool in water.

Gage Simplifies Pulley Alignment

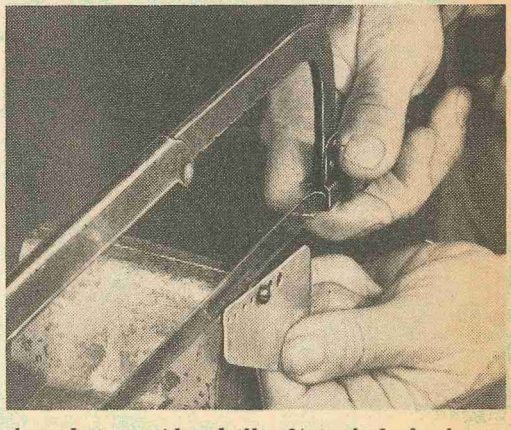
• With this gage made from a length of ⅜-in. tubing or bar stock, you can line up pulleys exactly to obtain perfect operation with minimum belt wear. Make a sharp 90° bend in the metal and cut it long enough to straddle



the pulleys on your equipment. To align two pulleys, fit the bent end of the bar into the V at the top and side of one pulley. Then adjust the other pulley until the bar fits into the V on top. To check your alignment of pulleys, repeat the test from beneath.

Holder for Sawing Small Screws

• With this holder, you can cut small screws to length and avoid dropping and losing them on the floor. Cut a tag of thin sheet aluminum, and drill holes to match common



thread sizes. Also drill a ⅜-in. hole for hanging on the wall. To use the holder, thread the screw through a matching hole, turn on a nut, and grip the threaded end of the screw in a vise. Hold the tag while sawing. Removing the nut cleans the threads.—E. M. Love.

Practical Hand Press

FOR bookbinding, flattening photo prints, making linoleum block prints and a variety of gluing jobs, this handy press is hard to beat. Basically, it is made from standard pipe fittings, scrap plywood and a length of threaded rod stocked in most hardware stores.

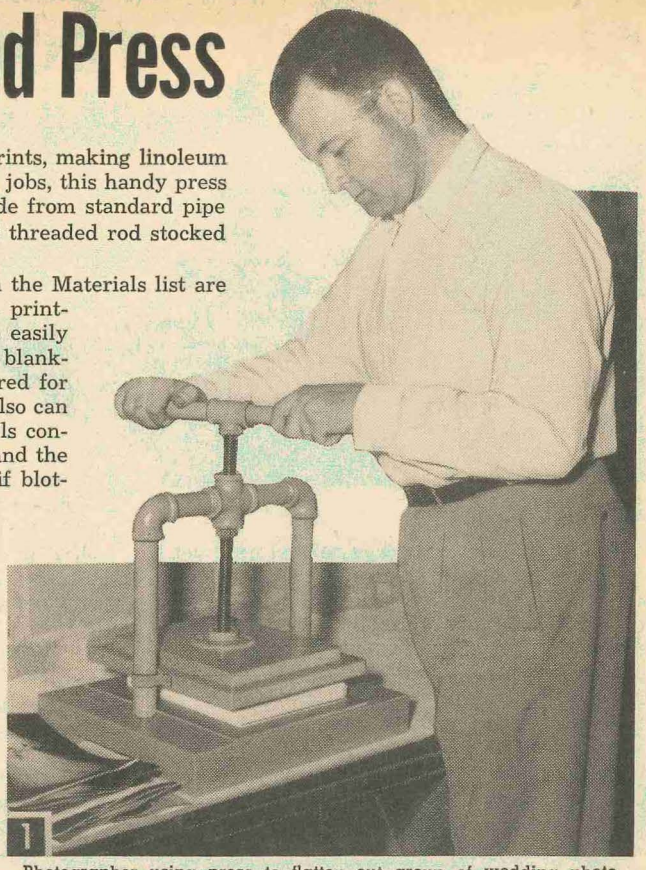
The two steel surface plates listed in the Materials list are optional. For linoleum or wood-block printing, securing the block on the base is easily done without the steel plate, and since blankets of newspaper or blotters are required for good printing, the steel pressure plate also can be eliminated, reducing cost of materials considerably. For flattening photo prints and the like, the steel plates are not essential if blotters are used between press and prints.

Construction. First glue up a base of two pieces of ¾-in. fir plywood (A in Fig. 2). Keep these under clamps until glue has dried and dress edges smooth and square on a disc sander, rounding edges slightly. Next, glue up a compression plate of two pieces of ¾-in. fir plywood, being careful to center top piece (B in Fig. 2). If you use the ⅛-in. steel plates, have them sheared to size (B in Fig. 2) and attach to pressure plate with four #8 x ⅝-in. *fh* screws countersunk slightly deeper than flush.

Next assemble 1-in. pipe cross, ells and nipples as in Fig. 2-C. Screw them together tightly, making sure that distance between pipe cross and each ell is equidistant, and space between nipple uprights measures 10⅝ in. With assembly secure, carefully center and mark location of nipple uprights on underside of base, using a try-square to align them parallel to base edges. Then bore (preferably on your drill press) 1⅞-in. dia. holes about ½-in. deep to recess flange hubs (Fig. 2-A). Next bore 1⅝-in. holes through base to receive uprights.

Slip pipe assembly onto base, screw on floor flanges (Fig. 3), and secure with 1½-in. *rh* screws to fit flange holes (Fig. 2-A). Attach two 1 x 3's to underside of base with #8 x 1½-in. *fh* screws. Then secure steel plate if one is used.

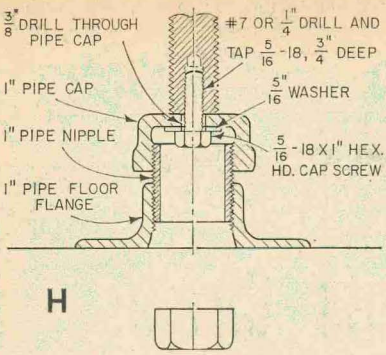
If you do not have a metal turning lathe, use the method shown in Fig. 2-H for fastening the ¾ in. threaded rod to the pressure plate. By making the ⅝-18 tapped hole in the ¾ in. rod only ¾ in. deep, you will be able to draw up the ⅝ in. cap screw

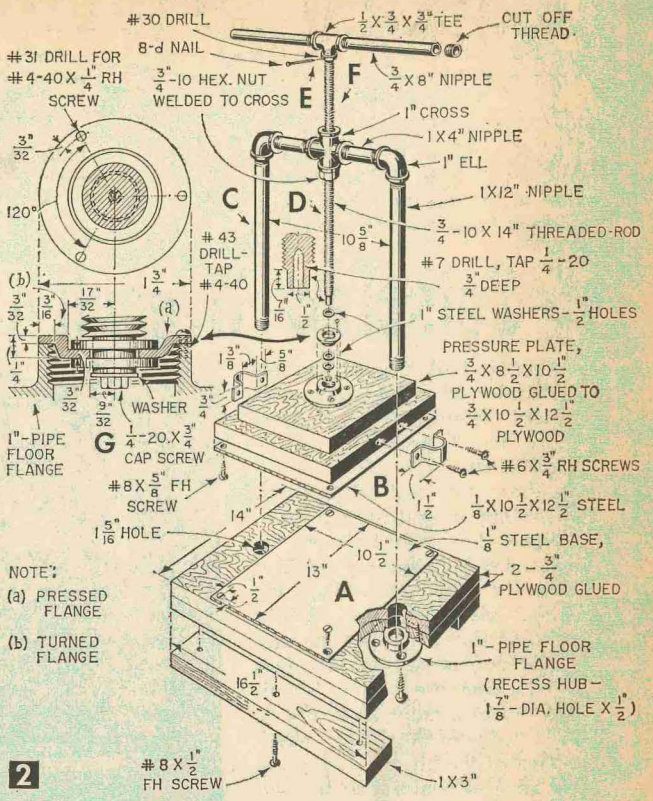


Photographer using press to flatten out group of wedding photo prints. Press is also ideal for bookbinding, gluing or linoleum block printing.

MATERIALS LIST—HAND PRESS

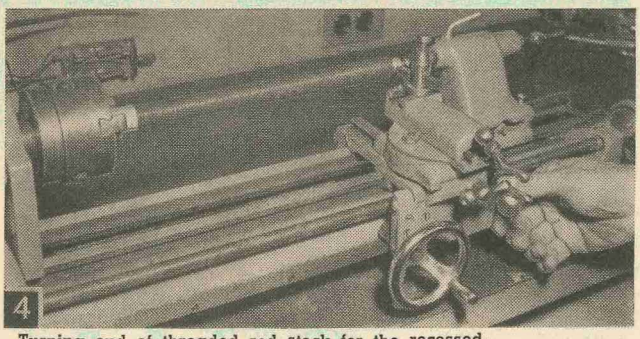
No. Req'd.	Size and Description	Use
2 pcs	¾ x 14 x 16½" fir plywood	base
2 pcs	¾ x 2⅝ x 16½" pine	base
1 pc	¾ x 8½ x 10½" fir plywood	pressure plate
1 pc	¾ x 10½ x 12½" fir plywood	pressure plate
	Pipe Fittings	
1	1" galv. pipe cross	
2	1" 90° ells of galv. pipe	
3	1" black-iron pipe floor flanges	
1	¾" std. hex. nut	
1	½ x ¾ x ¾" galv. pipe tee	
2	1 x 12" threaded galv. pipe nipples	
2	1 x 4" threaded galv. pipe nipples	
2	¾ x 8" threaded galv. pipe nipples	
1	1" close pipe nipple	
1	1" pipe cap	
	Miscellaneous	
1	⅝-18 x 1" hex. cap screw	
1	¼-20 x ¾ hex. cap screw	
1 pc	¾"-10 x 14" threaded rod	
2 pcs	1/16 x ¾ x 4½" mild steel, approx.	guide straps
2	1" dia. steel washers	
1 pc	1¾ dia. x 2" cold-rolled steel round	turned recessed washer
1	1¾" dia. recessed or steel washer	
1 pc	⅛ x 10½ x 13" cold-rolled steel plate (optional)	
1 pc	⅛ x 10½ x 12½" cold-rolled steel plate (optional)	
8	#8 x ⅝" fh wood screws	steel plate attachment
4	fh wood screws, 1½" x hole-size of flanges	
8	rh wood screws, 1½" x hole-size of flanges	
6	#8 x 1½" fh wood screws	base-batten attachment
4	#6 x ¾" rh wood screws	guide-strap attachment
3	#4-40 x ¼" rh machine screws	recessed-washer attachment
1	8d finish nail	handle securing pin



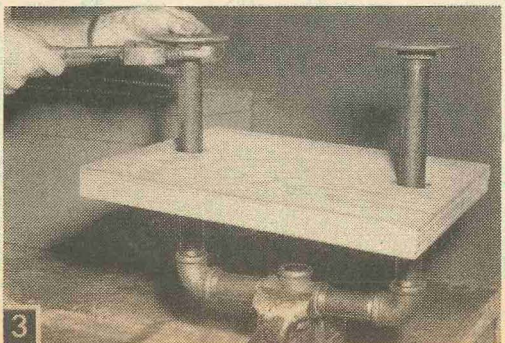


tightly and still have the 1 in. pipe cap rotate easily on the end of the ¾ in. threaded rod. Use more than one 5/16 in. washer if needed or file the end of the 5/16 in. cap screw.

If you have an engine lathe, and prefer the pressure plate attachment shown in Fig. 2-G, turn down one end of the ¾-in. 10 threaded rod to ½-in. dia. (Fig. 4). Then drill and tap the end (Fig. 2-D) for a ¼ in. cap screw. Now make up handle assembly from ¾-in. pipe nipples and a ½ x ¾ x ¾-in. pipe tee, cutting off end threads. Screw in the rod which, although the threads do not match, can be forced in about ¾ in. When clamping rod to do this, protect threads with several thicknesses of thin-sheet aluminum or wooden blocks. Drill a #30 hole through tee and rod and drive in an 8d finish nail for a securing pin (Fig. 2-E). Cut off point and peen over.


4

Turning end of threaded rod stock for the recessed-flange asembly. Note thin sheet aluminum in chuck to protect threads. Or use over-length rod and cut off chucked end.


3

For attaching supports to the base, use two floor flanges for a rigid assembly.

A recessed steel washer (Fig. 2-G) supports the pressure plate and permits a slight swivel action for equalizing pressure. The type used on polishing heads to secure abrasive wheels and the like is ideal. Or, turn one to the dimensions shown in Fig. 2-Gb. The pressed washers have a ½-in. dia. hole which should be reamed out or drilled to 9/16-in. dia. Two standard 1-in. steel washers, holes enlarged to ½-in. dia., serve as thrust bearings (Fig. 2-D and G). Carefully center recessed washer over pressure-plate flange (whose hub edge has been filed flat). Clamp and drill three #43 holes in washer and redrill its holes with a #31 drill to pass #4-40 x ¼-in. *rh* machine screws. Tap floor-flange holes #4-40 (Fig. 2-G). Accurately center the floor flange on the top of the pressure plate and fasten with 1½ in. *fh* screws to fit flange holes. Now, insert ¾ in. threaded rod through 1 in. pipe cross and thread a standard ¾ in. hex. nut (Fig. 2-F) on ¾ in. threaded rod. Center the nut against the cross and have it welded or brazed to the cross.

To assemble the rod to the pressure plate if you

have used the method shown in Fig. 2-G, slip a flat washer on rod end, then the recessed washer and another flat washer. Fasten these to the rod end with a ¼ in. cap screw and washer (Fig. 2-G). Next, attach recessed-washer assembly to pressure-plate flange with three #4-40 *rh* machine screws. Make two guide straps from 1/16-in. mild steel (Fig. 2-B), and attach these to pressure plate edges with #6 x ¾-in. *rh* screws. Straps must be a loose fit around uprights.

Sand all wood surfaces smooth and wipe metal parts with a cloth saturated with carbon tetrachloride to remove any oil or the like. Paint the press with two coats of enamel color of your choice. Do not paint threaded rod, steel plates (if used) or uprights. A little cup grease applied to the washer assembly before attaching pressure plate, and a few drops of medium-heavy grade motor oil on rod serve as good lubricants for the press.—HAROLD P. STRAND.

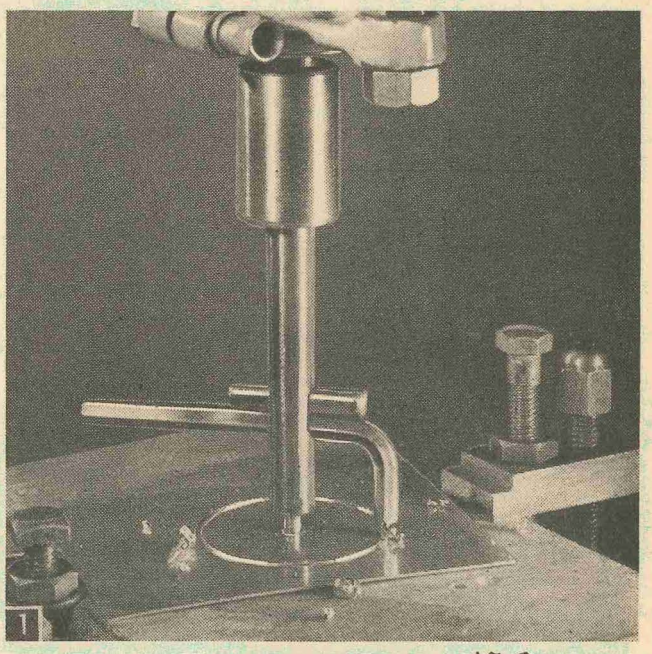
Setscrew Wrench Cuts Circles

THIS simple tool (Fig. 1) for cutting circles of various diameters in sheet material on a drill press will solve many problems in the home workshop.

Make the cutter slot (Fig. 2 and 2A) by milling or by drilling a series of ¼-in. holes in the steel rod, beginning about 1½ in. from one end and extending for approximately 9/16 in., cutting out remaining metal. File lower end of slot (Fig. 2A) flat and notch to accommodate opposite edges of bit. Machine the end of shank near the slot to a point as in Fig. 2. Flatten the edge of the wedge where it rests against the bit, and round the opposite edge to conform to the slot end. The wedge is ¼ in. thick and tapers slightly in width: the one shown tapers 0.020 in. per in. (being 0.275 in. wide at smaller end).

Grind the end of the short leg of the wrench to form a cutting tip with a 15° negative rake (Fig. 2B). Width of the tip can vary, that on the model being 1/16 in. For cutting wood, the tip can be used immediately, but for maximum wear, the cutter end can be hardened with a case-hardening compound such as Kasenit Compound (Kasenit Co., 3 King St., Mahwah, N. J. 1-lb. can about $3.00). Compound is applied by rolling hot tool (1650-1700°) in it and then reheating, or by burying tool in compound and heating together. Quench tool in cold water; reheat until yellow film shows on polished area, then quench again.

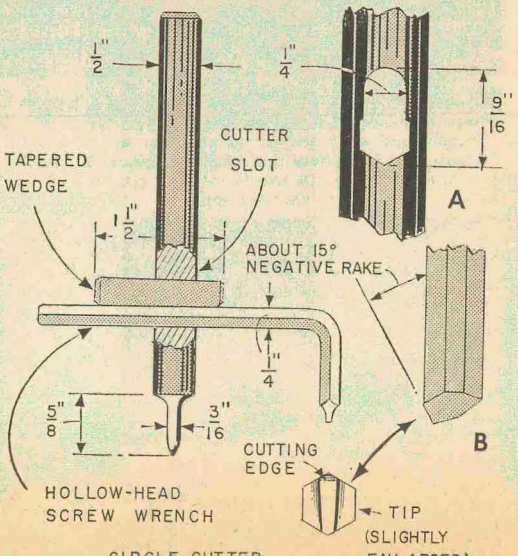
Securely clamp the work piece in place and drill a 3/16-in. pilot hole at the center point of the circle to be cut. Adjust the tool to cut a circle of the proper diameter and tighten by hammering the wedge in firmly. Then chuck in the drill press. When using a circle-cutting tool, always operate the drill press at the slowest speed.—W. E. BURTON.



1

MATERIALS LIST—CIRCLE CUTTER

Amt.	Description
1	½ x 5″ steel rod
1	wrench for ½″ hollow-head (Allen) setscrew: wrench measures ¼″ thick between flats
1 pc	¼ x 5/16 x 1½″, approx., steel, for wedge



2 CIRCLE CUTTER

SELECT ONE OF THESE PLANS FOR YOUR NEXT PROJECT

For our readers who enjoy building things in their workshops, we offer a wide variety of subjects. Every project in our line of craft prints has been designed by a master craftsman. Special thought has been given to the design and the ease of construction of each project. Many of the plans are full-size patterns. Others give the necessary parts in full-size to simplify construction. All of the projects listed in this catalog have been built. You can proceed with the assurance that your finished project will give you complete satisfaction if you follow our detailed, yet easy-to-understand instructions. Materials lists are included to aid you in ordering the necessary supplies. See handy order form on page 167.

Boat Building

11. BASS BOAT. Ideal craft to reach the best bass fishing areas where the fish feed in shallow water among the spatter docks. There's no propeller to foul in water weeds and, with a flat bottom and a 4-ft. beam along its entire length, the draft is at a minimum. The little air-cooled engine is easy to install and it has paddle-wheel propulsion; no shaft log is required. With ⅜-in. exterior plywood in a single panel on the bottom, you only need to calk along the chine lines. Length, 15 ft. It's an easy boat to build. $1.00.

14. SEA GAL. Tradition has it that it's the strong, broad-beamed heavyweights who are more stable when the going gets rough. Sea Gal's ample beam and 300 lb. weight make her ideal for the rough waters along the east or west coasts, the Gulf or Great Lakes. With a 14 hp outboard, this versatile utility boat will do 25 mph with one aboard and plane with three persons aboard. Construction is plywood over longitudinal framing for greater over-all strength. Length, 15 ft. 3 in. Beam, 5 ft. 4 in. Seating capacity 6 to 8 persons. $1.00

38. SUN FISH. The "Sun Fish" is an unconventional looking cruiserette which weighs only 375 pounds and is powered by an outboard. It can be transported easily and has accommodations for two persons for overnight trips. The scow-type bow allows it to be landed on shelving beaches which means dry feet for the passengers on embarking. Takes outboard motors up to 25 hp. Construction is simple. No difficult joinery work is necessary. Length, 15½ ft. $1.00

113. JAZZ BABY. This 12-ft. multi-purpose boat is an excellent all-around boat for fishing or speed. It rows easily, has a trim design, and the ability to maneuver well with small outboard motors of 6 to 15 hp. Built-in beveled chines make this boat unusually safe while a new-type bottom assures satisfactory operation at low or high speeds. Constructed of exterior marine plywood, the hull is easy to build, light in weight and permanently leakproof. The boat is seaworthy and stable. It is easily transported. $1.00

Multi-Purpose Boat—No. 113—$1.00

223. TAILOR-MADE BOAT TRAILERS. Whether you are looking for a light, fast trailer for your new 16- to 19-ft. cabin cruiser, or a serviceable small trailer for your outboard runabout, you will find the answer in one of the easy-built designs in this plan. Covers all construction details, bill of materials and step-by-step instructions. $1.00.

245. CAT'S PAW. Old-time, dyed-in-the-wool sailors look askance at sailing catamarans because of their unorthodox design. But these same sailors are usually looking ahead at them in a race because of the cat's speed. An easy sailer, cockpit high and dry even in stiff breezes. Safe for older kids and for learning to sail. An ideal summer camp boat. It can be used as a swimming float between sailing jaunts. Designed for easy construction with flat sides and bottom. Hulls are constructed from ¼ in. exterior-grade plywood. Length, 12 ft. Beam, 5 ft. 6 in. Depth, 21 in. Weight, 250 lbs. (twin hulls only). A boat you'll enjoy. $1.50.

271. JET JOE. Put it in water and—like a certain widely advertised soap—"Jet Joe" does everything. Not only does it do double duty as a utility and sports boat—hauling passengers, pulling water skiers and the like—but it also qualifies as a closed-course and marathon racer, fulfilling all requirements of the American Power Boat and National Outboard associations for sanctioned racing with stock outboard motors of 25 to 35 hp. Length, 13 ft. Beam, 63 in. Weight, 250 lbs. Seating capacity: Five passengers as utility-sports boat; one as a racer. Construction: Plywood sides and decking; multiple beveled sides for high-speed turns, flat planing areas. Medium-weight, excellent for rough waters, this highly maneuverable, general purpose boat for sports and utility use can be built easily from our plans. Have fun! $1.50.

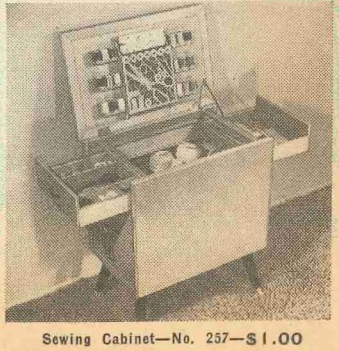
Sailing Catamaran—No. 245—$1.50

Cruiserette—No. 38—$1.00

Electrical Equipment

222. MOTION STOPPING STROBOSCOPE. If you want to know what is happening to a machine part that is moving at high speed, without turning off the motor, use a stroboscope. The stroboscope can be used to "stop" moving parts and study the movements of the parts in centrifugally-operated switches and clutches, or to inspect the shifting structure of a solid piece under centrif-

Boat Trailers—No. 223—$1.00



Sewing Cabinet—No. 257—$1.00

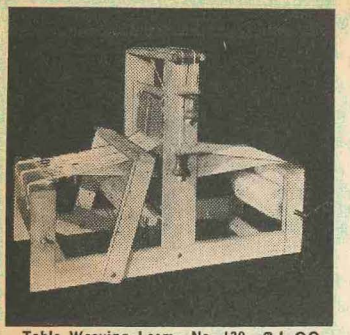
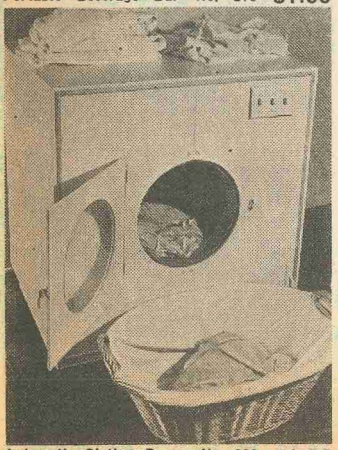


Table Weaving Loom—No. 139—$1.00

Multi-Purpose Divider—No. 241—$1.00

Portable Beverage Bar—No. 218—$1.00



Automatic Clothes Dryer—No. 229—$1.50

ugal force at various speeds, or to read stampings or markings on the moving piece, or to find out what may be causing unusual noises in motors and engines that are running. Easy to build, inexpensive and practical. $1.00

246. AC TRANSFORMER ARC WELDER. Once you have used an arc welder in your shop you will wonder how you got along without it. For making new things of metal or repairing old things it has no substitute. This welder is an AC transformer type rated at 150 amps when connected to a 220/240V, 60 cycle, single-phase circuit. Maximum output when operated wide open is 180 amps at 60V. It will handle welding electrodes (rods) up to and including 3/16 in. dia., which is large enough to weld steel several inches thick by the multipass method. By rearranging two connecting links, the welder can be used on 110/120V house current fused at 30 amps for use with 1/16 and 3/32 in. electrodes. Because of the hand-wheel controlled, movable core-shunt transformer design, the welding-current setting can be regulated to a fraction of an ampere throughout the full welding range. Every construction step is fully explained with detailed drawings. $1.50

250. MOBILE ARC WELDING SELENIUM-RECTIFIER UNIT. By connecting this selenium-rectifier unit to an AC welder, you can use any type electrode of either straight or reverse polarity—the same as used with expensive DC motor-generator welders. Also, if this rectifier unit is connected to an AC welder, you can operate DC motors of 24 to 32 volts, pumps and the like up to 3 hp. if the voltage rating matches the output voltage of the rectifier. $1.00

265. ELECTRICAL COIL-WINDING MACHINE. Unless you have a machine capable of holding and turning a coil-winding form at a slow speed, winding a coil having hundreds of turns can be quite a chore. This machine has been designed to wind coils for transformers, solenoids, etc. It is powered with a used Hoover vacuum-cleaner motor and has a foot controlled reactor offering an infinite number of speed control steps. Our plans show you exactly how to construct this handy piece of electrical equipment. $1.00

Home Furnishings and Equipment

139. TABLE WEAVING LOOM. Weaving is one of the oldest arts of mankind. Beautiful patterns and fabrics up to 12 inches wide can be woven on this loom. This loom is easy to construct and will turn out work equal to professional jobs. You will find weaving fascinating and profitable. In addition to giving you complete instructions for building this loom, our plan explains how to weave. By following these simple instructions, you can make many beautiful fabrics. $1.00

204. MODERN BARN. You can save up to $4,000 by building this 36 x 50 ft. modern barn. The new design and laminated construction methods make it easy to build. Includes built-in stanchions, box stalls, feed rooms, hay chutes and post-free hay mow that holds 50 tons of loose hay. Detailed plans explain how to pour the concrete footing, lay the concrete block walls, raise the laminated rafters and complete the barn. Hundreds of our readers have built this barn and have made substantial savings. It is roomy, convenient to work in and designed for almost any purpose. Two large plan sheets explain everything. $1.50

218. PORTABLE BEVERAGE BAR. Ideal for home or small apartment use, this beverage bar can be folded up into four lightweight pieces and stored in a clothes closet or carried in your car to a friend's house. The bar is large enough to accommodate six people comfortably and will be the center of interest at any house party. It can be constructed of knotty pine, wall-panel type plywood, mahogany, oak, grooved or sandblasted fir plywood—whichever best harmonizes with the room walls. Every step needed to explain the construction is given in detail. Build one for your next party. $1.00

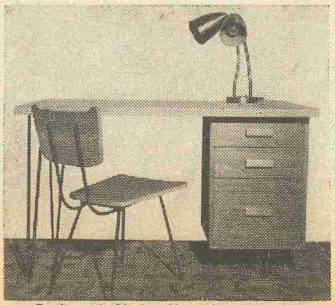
229. AUTOMATIC CLOTHES DRYER. Now you can build a 110-volt automatic clothes dryer for approximately $80.00. It will simulate sunshine and destroy odors and bacteria. It will take about 9 lbs. of clothes and dry them in 45 minutes to 1½ hours depending upon the type and weight of clothing material. Complete instructions, bill of materials and detailed drawings show you how to build this useful home appliance. $1.50

231. MODERN MATCHING DESK AND CHAIR. This artistically proportioned desk and chair of modern design is sturdy, functional and has a working-size top. Three drawers, one of filing-drawer size, provide plenty of storage for stationery, accounts and personal receipts, bills, etc. Construction is simplified by using large panels of veneered ¾-in. plywood which serve as both framing and covering material. Wrought iron legs and chair frame make this an interesting combination metal and woodworking project. $1.00

241. MULTI-PURPOSE ROOM DIVIDER. Although this room divider has the appearance of a built-in unit, it is completely portable and may be moved about the same as other pieces of furniture. Its basic purpose is to separate two rooms but it can be used as a buffet for party snacks, a china cabinet, knick-knack display rack and storage unit for dishes, glassware and bottle goods. Helps to make your home more livable. $1.00

252. CONCRETE STAIRS. If you have always admired those neat concrete stairs with ornamental iron railings, here's how you can do it yourself at a big saving. You save in other ways too; the improvement will increase the resale value of your property, and concrete stairs will never rot and need replacement or painting. This plan shows how to build the concrete foundation wall, prepare and pour the concrete mix, finish the surface, and install the iron railings. Add beauty to your home. $1.00

253. ROLL-AWAY LAWN FURNITURE. By carefully nesting all of the pieces of this project together, you can make a



Desk and Chair—No. 231—$1.00

Roll-Away Lawn Furniture—No. 253—$2.00

cocktail table, two comfortable chairs and a chaise lounge from one sheet of plywood. A full-size pattern, plus detailed instructions for cutting, assembling and finishing this project are given. All you need do is to trace the pattern and start cutting the parts. Lightweight construction makes it easy to roll the entire set away for storage. $2.00

254. KITCHEN VENTILATOR. You can now easily carry away cooking odors and grease-laden fumes with a kitchen ventilator installed to your exact requirements. Whether you need a ceiling ventilator, a cabinet ventilator or a wall ventilator, this plan will show you how to build it. Explains the basic needs for each type of ventilator and which one will give you the best results. Enjoy the added comforts a kitchen ventilator will give your family by installing one now. $1.00

257. SEWING CABINET. At first glance this project looks more like a chairside end table than a sewing cabinet for it makes an attractive addition to any living room. Yet, it contains two half-length, tray-drawers at the top, a lid that holds spools of thread and dress patterns, a large 6-in. deep storage cabinet, and a full-length drawer at the bottom. The arrangement of the cabinet is such that you get maximum use of the space. A detailed bill of materials, step-by-step instructions, and large, clear drawings make it an easy job to build this project. The ideal surprise gift for your wife. $1.00

268. SUMMER HOME. City convenience without the cost is yours with these fully detailed plans for a dream home at the lake or in the woods, a home you can build yourself even if you've never before attempted a major project, a home you can build for less than $2,000—a fraction of what commercial builders would charge. Perfect for vacation or weekend fun, the summer home has a living room 15 ft.-2 in. x 21 ft.-4 in., with a wood-burning fireplace 6 ft. wide, a bedroom 9 ft.-9-in. x 9 ft.- 8 in., cross-ventilated for sleeping comfort, and a kitchen with space for range, refrigerator, sink, snack bar, cupboards and a spacious work counter with picture window. Shower and toilet are off bedroom, plans also include construction procedure and diagrams for an 8 x 18 ft. screened porch and instructions for adding an extra room and garage. Step by step you're shown exactly what to do and how to do it; nothing is left to guesswork. You can start your dream home the minute you get our plans. Full set, $5.00

273. POWER CULTIVATOR. It is amazing how much time and energy can be saved with this 12-in. power cultivator. It will prepare your flower beds and garden plots without the backbreaking chore of hand spading. Whether you choose to pulverize the soil or cultivate between the rows, this power cultivator can handle the job. Power is supplied by a 1½ or 2 hp, 4 cycle Briggs and Stratton gas engine which has plenty of power even at half throttle. Simplicity of construction was foremost in mind when this cultivator was designed so it could be built with the minimum of tools; that is, hacksaw, file, screw driver, wrench and a ¼ inch electric drill. The only work that might need to be done outside your shop is reboring the 24 tooth sprocket and the welding or brazing. Our plan explains every detail. $1.50

Jigsaw Projects

26. 18th CENTURY WALL SHELF. The scrolled grape leaf pattern of this shelf blends in with the design of this wall-piece for displaying figurines, vases and chinaware. It provides a project for the woodcraft hobbyist that may well be an heirloom in the years to come. Size: 23½ in. long by 26¾ in. high and 5⅝ in. deep. Full-size pattern. 50¢

Modelcraft

23. MODEL OF 1850 HORSE-DRAWN STATION WAGON. Here is a fashionable rig that Grandpa used for attending races, going to parties and meeting the trains. They were usually painted black with bright red upholstery, a lemon yellow undercarriage and bright red, rubber-tired wheels striped in black. You will find this an interesting project to build and one, if used as a mantle piece, that will cause plenty of comments. $1.00

151. ELECTRON III. Here is the very latest in scale model cabin cruisers—a model that will run rings around any single channel radio-controlled job on the water. A unique remote control system permits you to run it without any expensive radio transmitters or receivers. What's more, no FCC license is required to operate the remote control unit. You just aim a beam of light, from shore, at the rotating photocell on the model and she responds to your command. It's fantastic! It's fun! And you can build one easily from our plans and instructions. All parts are readily obtained. $1.50

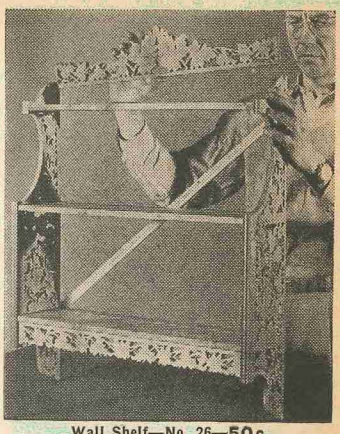
158. MODEL OF 1903 FORD. The original Model A Ford Automobile was built in 1903, just seven years after Henry Ford constructed his first gasoline-powered vehicle. This authentic ¾ in. scale model is a must for your collection of antique automobiles. The full-size drawings and materials list enable you to build this model from scratch. $1.00

163. STEAM CALLIOPE. One of the most fascinating pieces of circus equipment. From this plan you can build an exact replica, true to scale, including boiler, pipes and keyboard. Detailed drawings and instructions explain how to cut the carvings, assemble the wagon, with a color scheme for painting and decorating. Complete materials list makes it easy to get started. Overall length, 12½ in. $1.00

168. 1909 STANLEY STEAMER. One of the fastest cars of its day. Broke the world's record with a speed of 127 mph in 1906. This ¾ in. scale model is authentic in styling and detail. Complete materials list, step-by-step drawings explain how to build this model. $1.00.

169. REMOTE - CONTROLLED MODEL CHEVROLET. Makes an excellent project because it gives the average model builder or automobile fan an authentic scale model to construct, or for those who prefer a working model with radio control, it is ideal. $2.00

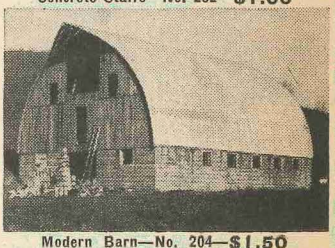
256. HASTY HORNET, JR. Weighing less than 16 ounces, this 16½-in. long, sleek model hydroplane with its battery-powered outboard motor will speed along at well over 30 scale miles per hour. It's a one-eighth scale model of our famous high-speed hydroplane "Hornet" (Craft



Wall Shelf—No. 26—50c

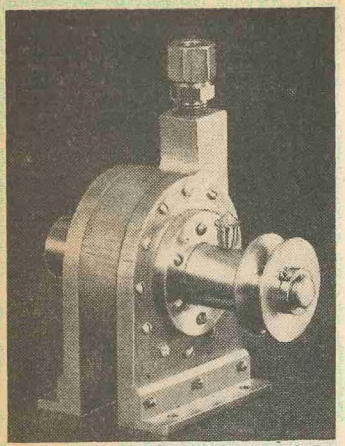
Stanley Steamer—No. 168—$1.00

Concrete Stairs—No. 252—$1.00

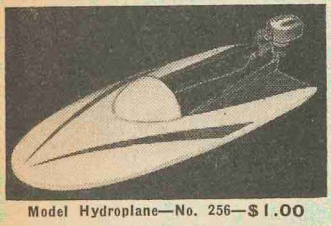


Modern Barn—No. 204—$1.50

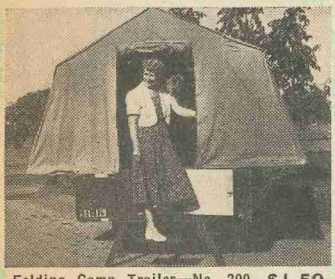
Vacation Home—No. 268—$5.00



Midget Centrifugal Pump—No. 259—$1.00



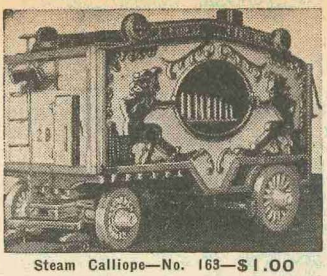
Model Hydroplane—No. 256—$1.00



Folding Camp Trailer—No. 200—$1.50

Vacation Trailer—No. 238—$2.00

Powercycle—No. 215—$2.00



Steam Calliope—No. 163—$1.00

Print 161) that has won so many races. Full-size plans make it easy for you to build this project. If you want speed, fun and thrills at your next model show, build "Hasty Hornet, Jr." $1.00

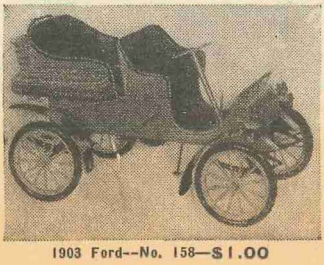
259. MIDGET CENTRIFUGAL PUMP. You can put this little pump to a variety of practical uses requiring a continuous flow of liquids from sources free of sand or other gritty substances. It is just the right size for a forced-coolant system on high-speed machine tools; for aerating small fish ponds or large aquariums; for window displays, or indoor or outdoor fountains. The output capacity of the pump will vary depending on its nearness to the liquid source, its operating speed and sizes of intake and output pipes. No castings are required to make this pump as all parts are machined from solid brass flats and rounds, except for the impeller shaft, which should be stainless steel to prevent rust. These plans are full-size to make it easy for you to construct this project. $1.00

Sports and Vacation Equipment

50. CABIN TRAILER. Ideal for weekends, fishing or vacation trips. Compact, roomy, comfortable; sleeps two people. Designed for all modern conveniences—sink, water tank and pump, stove, kitchen table, cupboard, clothes closet, drawer chest, storage space, electric lights, ventilator, etc. Sturdy, simple construction. Overall body length, 12 ft. 6 in., weight 1,100 lbs. Our master plan gives bill of materials, explains every construction detail. $1.00.

200. FOLDING CAMP TRAILER. Camping out can now be a pleasure. With "Handy Andy," you can carry your tent with you (taking about 10 minutes to set up) in a light trailer that tows easily and also carries your boat. Inside there's sleeping room for three adults or two adults and three children. You also have space for cooking in bad weather. With its 20 in. road clearance, you can haul "Andy" any place you can drive a Jeep or pick-up truck—right back to where the trout are hungriest. Two large plan sheets show you how to build this trailer. $1.50.

215. SUITCASE-SIZE POWERCYCLE. As an errand runner or for short distance commuting, this midget motorscoot would be hard to beat. Designed so that the handle bars fold down and the foot pedals fold in, this powercycle will easily fit into the trunk of your car. You can build this pint-size powercycle for about $110.00. Commercial powercycles regularly sell for



1903 Ford--No. 158—$1.00

1850 Station Wagon—No. 23—$1.00

over $200 to $400 and none of them fold up the way this one does. Three large plan sheets showing all necessary parts in full size, plus the step-by-step construction details simplify the building of this project. Nicky Frances, the famous clown, has featured this powercycle on the famous Super Circus Television Show. Build one! You'll have hours of fun and enjoyment. $2.00.

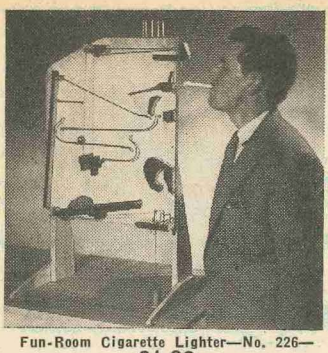
238. VACATION TRAILER. You'll save money in two ways by building your own vacation trailer. First, because you can save one-half the cost of a comparably built and equipped new factory trailer. Second, because the two largest vacation expenses, lodging and meals, for you and your family will not be much more than if you stayed at home. The plus feature of having a vacation trailer is that even summer week-ends can become short-trip, fun-packed vacation days. You'll find real comfort, too, because this trailer provides sleeping, cooking and eating accommodations for a family of five, yet it is small enough to be towed by a modest family car. Plans provide for a 14 ft., 16 ft., or 18 ft. trailer. All construction details are explained, including electrical wiring, insulating and completing the exterior and interior. Sources of supply are given for all materials and parts to simplify construction. $2.00.

Toys

226. FUN-ROOM CIGARETTE LIGHTER. This is without doubt the goofiest, most complicated cigarette dispenser and lighter there is. It would probably come under the heading of Basement Game-room Gimmicks, although it could and has been used as a TV, office and party gag on many occasions. If you have the reputation of being an inventive or mechanically minded type of person, you'll have a lot of fun with it, offering your friends a cigarette and watching the look of amazement on their faces as the machine automatically goes through a series of mechanical movements with chain reaction regularity until a match is ignited. After a short pause, the match is extinguished with drops of water, again automatically controlled. You can find most of the material to make this gadget around the house. Have fun! $1.00

234. ELECTRIC DART GAME. You can really ring the bell with this dart game if your aim is good. The red-ringed bullseye circle in the center not only rings the bell when hit, but also lights up a red jeweled lamp. If your dart strikes one of the different colored circles surrounding the bullseye, a light of the same color will glow at the top of the target. A

Remote Control Chevrolet—No. 169—$2.00

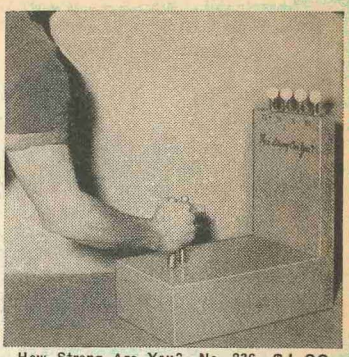


Fun-Room Cigarette Lighter—No. 226—$1.00

hit in the bullseye counts 50 points, and one in any of the surrounding circles counts 10 in scoring. Built from easily obtained materials. Pictorial wiring diagrams, drawings and photos show every step to make this fine game. $1.00

236. MUSCLE-POWER MEASURER. The way to get a good grip on yourself is to practice with this game room machine. Although built primarily for fun, it is an ideal hand exerciser. And your family and friends can have a whale of a time finding out who has the strongest grip from week to week. The machine registers 25, 50, 75 or 100-point grip. How strong are you? Test your grip with this muscle-power measurer. Our plan gives construction details, wiring diagram and complete materials list. $1.00

263. TABLE-MODEL BOWLING ALLEY. Not just a toy, this game requires plenty of skill. Experienced bowlers have scored from 135 to 247, and as yet haven't solved the consistent-strike formula. Just when you feel it's a cinch to play this game, and your ball hits the head pin squarely on the nose, you wind up with a split between the #7 and #10 pins almost big enough for a parking lot. This miniature alley is accurately scaled to approximately ⅛ that of the standard bowling alley, with the exception of its length, which is somewhat shorter to allow for practical table-top playing. Its an ideal game for your recreation room. You can form teams and run tournaments. "Headpin Charlie" does your bowling for you so it is up to you to



How Strong Are You?—No. 236—$1.00

position him correctly behind the foul line and give the "ball" the proper speed. You'll be amazed at the skill required to match your league average. Detailed drawings and a step-by-step construction procedure explanation show how to build this splendid project, plus instructions for playing and keeping score, $1.00.

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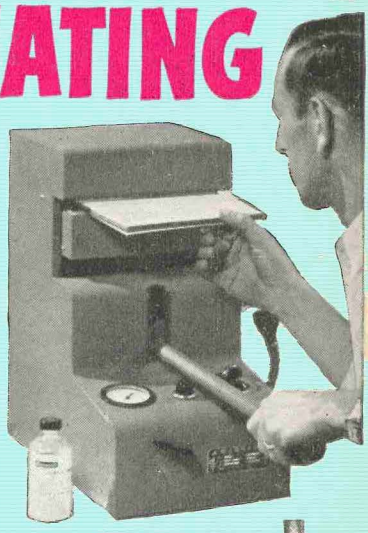

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No house-to-house canvassing. No face-to-face selling. We not only supply the equipment you need for the work, but also show you exactly how to cash in big daily profits from two big demand fields.

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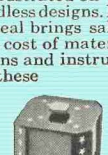
Millions of people want to protect valuable cards, photographs, documents and papers against wear, soil, and damage. By our MAGIC MAIL Plan you get this business through the mails. Open envelopes and take out money and orders. Details of this plan will amaze you. It will be sent free. Just mail coupon.

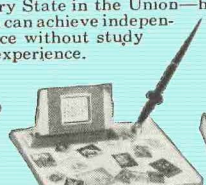
ENORMOUS PROFITS IN LAMINATING

A creative, artistic business. Gift shops sell your entire output. Just a few of thousands of giftwares illustrated on this page. Beautiful colors. Endless designs. Exclusive "one of a kind" appeal brings sales at ten to twenty times the cost of materials. Beautiful illustrations and instructions for making these artistic novelties sent free.



NO MONEY— Just Send Name!

The opportunities in Plastic Laminating are so big that space here does not permit even skimming the surface. To get any idea **FREE** at all of the size of these markets and your place in this sensational business you must read the details. See for yourself how easy it is to do the work—how you can put plastic sheets into your machine and take out a fortune—how money and orders come to you in the mail—how gift shops clamor to get more and more of your creations—how you can start with one machine and build up a big production plant with others doing the work—how you can get money and business from every State in the Union—how you can achieve independence without study or experience.



RUSH COUPON

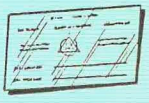
Never before has such an opportunity been offered the small, home-operator—an opportunity to gain complete personal independence in a big money business of your own. Don't lose a minute. Get the facts at once. All information, fully illustrated with pictures, is free. Send the coupon—or send your name and address on a postcard. There is no charge now, or at any other time. Send for the information on this exciting opportunity today.

WARNER ELECTRIC CO.
1512 Jarvis, Dept. L-238-K, Chicago 26, Illinois

Cash Money Comes to You in the Mail

By our MAGIC MAIL Plan you sit at home, send out mail, and get back money and orders. Additional profits in supplying lifetime protection for SNAPSHOTS—IDENTIFICATION CARDS—DISCHARGE PAPERS—DRIVERS' LICENSES—SOCIAL SECURITY CARDS—VOTERS REG. CARDS—MENUS—BIRTH CERTIFICATES—CREDIT CARDS—BIRTH AND WEDDING ANNOUNCEMENTS—PASSES—DOCUMENTS.

Lifetime protection. See how laminating prevents soiling, wear, and moisture damage with flexible, plastic covers.



Thousands of Beautiful ART CREATIONS

Made by Laminating as explained in our Free information. Send coupon for list and pictures of COSTUME JEWELRY—JEWELS—CIGARETTE BOXES—CUFF LINKS—NOVELTY BUTTONS—TRAYS—CANDLESTICKS—COASTERS—CLOCK CASES—LAMP BASES—PICTURE FRAMES—BOOK ENDS—CHARMS—ADVERTISING SIGNS—NAME PLATES—BELT BUCKLES—CHECKERS—PAPER KNIVES—CHESSMEN—BOOKMARKS—TIE RACKS—KEEPSAKES OF ALL KINDS.

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1512 Jarvis Avenue, Chicago 26, Illinois

Please mail, postage prepaid, complete information with illustrations showing the things I can make and the money possibilities in Plastic Laminating. All this is free. No Salesman is to call. Also, tell me how I get orders and money from my Postman by the MAGIC MAIL Plan.

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• Blade tilts and locks any angle to 50° • Blade raises and lowers 0" to 2¼" • Precision ground cast iron table • Saw insert removable for any standard dadoe heads, cutters, etc. • Takes any standard ¼ to ½ H. P. motor • Patented motor mount keeps belt always tight — transmits full power at all times • Accessories — table extensions, etc. available at low factory cost • Designed, manufactured, and unconditionally guaranteed by AMERICAN MACHINE & TOOL COMPANY — manufacturers of quality power tools and pumps since 1929.

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than previous models sold for over $20.00

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SEE THESE QUALITY FEATURES

• Precision ground cast iron tables • Rigid cast iron base • Rabett depth ⅜" • Table adjustable for depth of cut • New patent pending fence assembly adjusts any position, any angle 0° to 50°. Patent pending design holds clearances between knives and tables at any depth • New patent pending guard assembly. Nothing to loosen; just lift off • Balanced steel cutter head • Hardened and ground high speed steel knives.

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